OCTOBER 1960 VOLUME 9 . NUMBER 10

Battelle Technical Review

IN THIS ISSUE : Microwaves in Scientific Research

VIGNETTE

SHERWOOD L. FAWCETT

An abundance of energy is a prerequisite of an advancing civilization, and through current nuclear studies, science and technology are assuring the energy that will be needed in the future. So says nuclear physicist Sherwood L. Fawcett. "What is happening", he points out, "is that our society is getting a running start on the development of nuclear energy. As our rapidly growing population strains present fuel supplies, the power of the atom will become economic and take over the burden of providing energy for the continued expansion of the economy."

Sherwood's research responsibilities have been centered largely in working with and providing guidance for a group of gifted colleagues who have been responsible for major advances in the field of nuclear research. Studies by this group led to the development of an unique, totally-submerged in-pile loop for research in the Battelle reactor and of a gas-cooled in-pile loop for the Engineering Test Reactor at Arco, Idaho. Sherwood has guided studies of the economics of advanced fuel systems for the Enrico Fermi fast-breeder reactor and supervised engineering programs to determine the performance and reliability of reactor fuel-element and structural-component designs. He is active, also, in the evaluation of reactor concepts. In earlier years, he participated in research for the Submarine Thermal Reactor.

In all of these studies, like his colleagues, Sherwood finds himself "hooked" by the excitement of the scientific chase and joins in the enthusiasm of his co-workers generated by their interest in the problems under study.

During his years at Battelle, Sherwood, who is manager of Battelle's Department of Physics, has played an increasingly important role in the growth of nuclear research at the Institute's research center. After participating in the planning and construction of the Institute's research reactor and the critical assembly, he helped plan and establish research in reactor and reactor component engineering. He has shared, also, responsibility for the broadening of Battelle's nuclear research program.

Sherwood received both his M.S. and Ph.D. degrees in physics from Case Institute of Technology, where he held an Atomic Energy Commission predoctoral fellowship. His B.S. degree in engineering physics was received from Ohio State University. He joined the Battelle staff following the completion of his doctoral studies.

In line with his interests and responsibilities, Sherwood's professional society affiliations incude the American Nuclear Society, and the American Physical Society.

For relaxation, Sherwood indulges in a wide variety of do - it - yourself activities around home. He also enjoys hi-fi listening and extra-curricular reading. Along with his wife, Martha, he watches with delight the antics of Paul, Judy, and Tom, six, four, and two years old, respectively.

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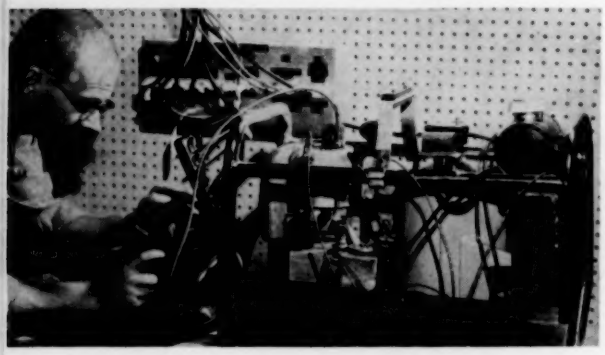
Data on engine conditions are transformed into electrical impulses by suitably installed transducers and carried by the connecting wires through the cable to the recorder. The technician is checking the operation of the free piston engine compressor.



The recording equipment used at Battelle in the study of machines includes three major units. The power supplies for amplifiers for transducers are located in the left console. The oscillograph recorder (center console) gives an immediate usable record of events that have taken place; it can record directly from the transducers or re-record from tape. The tape recorder (right console) is set up here with a tape loop, which continuously stores data for brief periods before erasure so as to have on record the conditions leading to an unusual event such a stalling of an engine. An automatic device stops the tape and preserves the desired record. A continuous record may be stored on large reels.

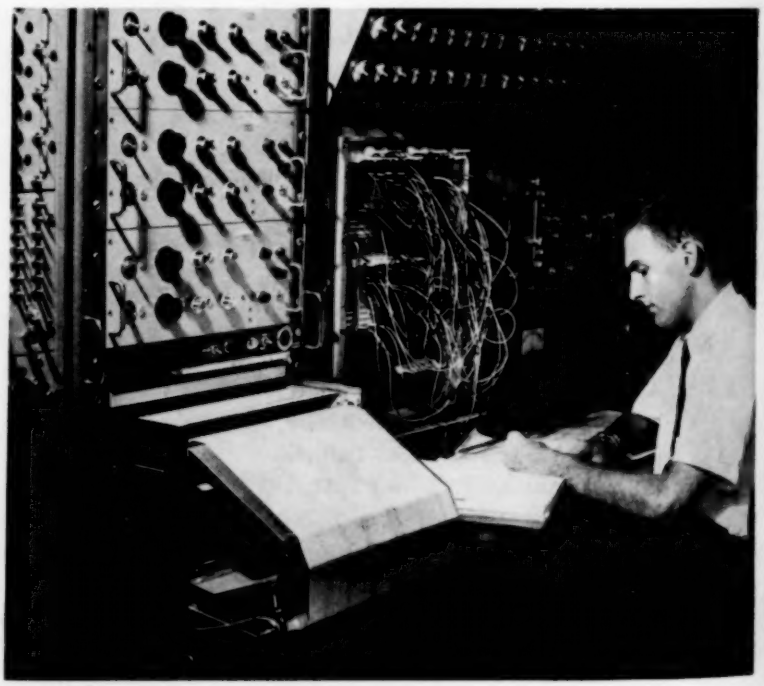
STUDYING ENGINES THROUGH RECORDED DATA

Research on internal combustion engines calls for the study of a number of conditons that exist simultaneously as they operate. In many instances, repeated reproduction of the conditions is necessary to learn what is happening. With the recording equipment shown above right, Battelle technologists are able to record simultaneously as many as 14 kinds of data for later study.

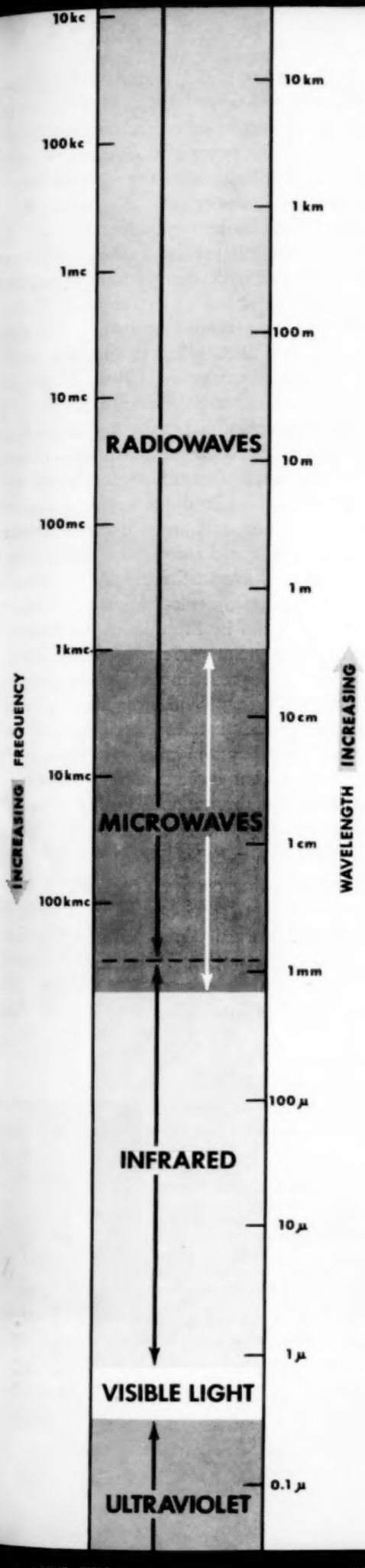
In studies of engines such as that shown above, recordings may be made of ignition voltage; valve and piston motion; combustion, compressor, fuel system, and manifold pressures; and other conditions. The various types of impulses—such as pressure, motion, and velocity—are transformed to voltages by transducers and recorded on tape.

Robert Mitchell, who is one of a group conducting a current study, states that the recorder makes possible the determination of the effects of changes in conditions on the efficiency of the engine's operation and upon other conditions. Thus, the technologist can readily note how changes in ignition voltage, for example, affect combustion pressure characteristics.

Because tape-recorded data can be reproduced at varied speeds, it may be fed into an analog computer which, in turn, can provide data not otherwise obtainable. On the basis of pertinent data from the engine's operation, for example, the computer can be used to provide information on transient response to changes in load or fuel settings.



Engine parameters may be determined by feeding taped data into the analog computer. Some parameters, such as internal friction, cannot be taken directly from the engine. They can, however, be determined from the relationships of other data that are obtainable. When the available data are supplied to the analog computer from the tape, the derived data are recorded as shown here.



Microwaves in Scientific Research

Microwaves are providing physicists with valuable new research tools. The author describes new developments in the field and reviews their uses.

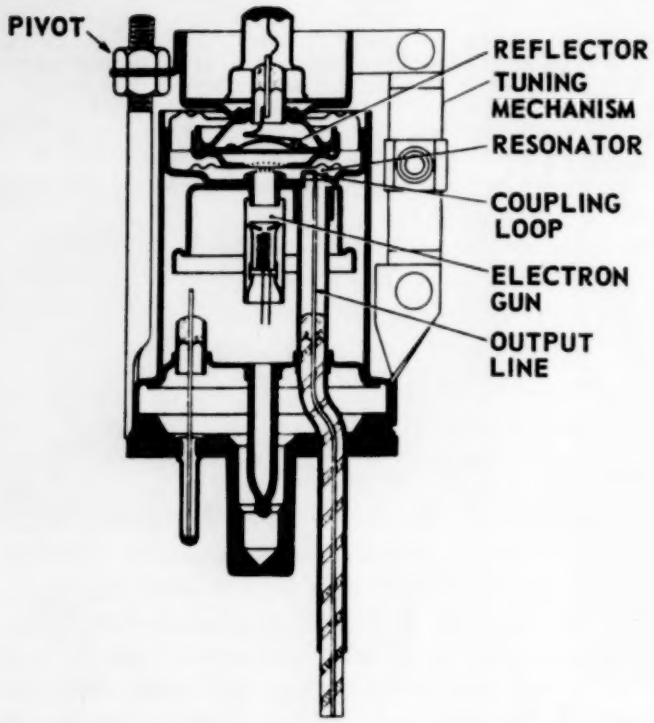
by DIPL.-ING. HANS HERBERT KLINGER

BEFORE WORLD WAR II comparaively little was known about the applications of microwaves to scientific research. Although these waves had been generated to a limited extent for many years by means of spark-gap generators, Barkhausen-Kurz tubes, and simple magnetrons, the greatest advances in the field of microwave technique took place during the recent war. The progress resulted from the concentrated efforts of teams of scientists and engineers engaged in the development of microwave radar. Vastly improved new methods for the generation, reception, transmission, and measurement of microwaves have provided the physicist with important new research tools. It is the aim of this paper to review some of the progress made in this new field of scientific research.

Microwaves are very short radio waves covering the range roughly between 30-cm and 1-mm wavelengths, or frequencies between 1,000 and 300,00 mc (megacycles). This portion of the electromagnetic spectrum, which bridges light and radio waves (illustration), is of interest to scientists in many fields. The physicist is especially anxious to study the absorption spectra of gases and paramagnetic and ferromagnetic resonance in the microwave region. The astrophysicist and astronomer measure the microwave radiation coming from the sun, stars, and clouds of gas in space. The biophysicist can achieve better understanding of living matter by studying the behavior of biological tissues and bacteria in the radiation field of centimeter and millimeter wavelengths; the nuclear physicist wishes to harness microwaves to accelerate electrons and protons for bombarding nuclei and to study and control nuclear reactions.

GENERATION OF MICROWAVES

Microwaves are usually produced and amplified by means of klystrons, magnetrons, and traveling-wave tubes of different kinds. For use in microwave spectroscopy and other measurements important in scientific research, the reflex klystron is particularly useful. It operates by emitting electrons from a cathode which, after travel and repulsion in the drift space, bunch at the gap of the cavity resonator and stimulate cavity oscillations. In this manner, energy is transferred from the electron beam to the microwave field. The frequency of a reflex klystron may be varied



1. *Sketch illustrating important elements in a reflex klystron. Electrons are emitted from the electron gun toward the reflector. After being reflected, the electrons bunched in the resonator gap are coupled to the output line, and thus energy is transferred from the electron beam to the microwave field.*

mechanically by changing the shape of the resonator by pressure or by screwing in a tuning plunger. Alternatively, the frequency may be swept electronically over a small range by varying the voltage applied to the reflector. The shortest wavelength generated feasibly by reflex klystrons is about 2.5 mm.

Much more powerful microwaves can be obtained from pulsed magnetrons. In a magnetron generator a cylindrical cathode is surrounded by a cylindrical anode into which resonant slots are cut. The paths of electrons drawn toward the anode are bent by a static magnetic field so that the electrons circle the cathode. The microwave-frequency fields of the resonator slots bunch the electron flow into spokes, and the microwave-frequency current of these spokes in turn excites the oscillation in the anode structure. The electrons reach the anode with only a small kinetic energy. The energy from the voltage applied between cathode and anode is largely transferred to the microwave-frequency field.

Magnetrons are usually pulse-operated with high anode voltages and have produced the shortest wavelengths thus far of any type of electron tubes. At wavelengths between 10 cm and 3 mm, peak output powers range from the order of 300 kW to 2 kW with efficiencies between 30 and 5 per cent. Very short wavelengths of the order of 1.1 mm have been obtained from magnetron harmonics.

There are other microwave tubes such as travelling-wave tubes using different types of slow-wave circuits. In some of these transit-time tubes the electron beam interacts with spatial harmonics of an electromagnetic wave propagating along an array of resonator slots.

The shortest wavelength yet achieved by electron means has been obtained by frequency multiplying the output from a reflex klystron by means of a silicon-tungsten diode used as a nonlinear device. The sixteenth harmonic from a 2K33 reflex klystron has been produced by this technique giving a wavelength of 0.77 mm.

There are still other possibilities for the generation of very short microwaves based on the radiation from very fast electron beams, such as the "relativistic Doppler method" (Undulator) and Cerenkov radiation which takes place when a charged particle moves through a medium at a speed faster than the velocity of the electromagnetic wave in that medium.

Recently, some solid state devices known as Masers (Microwave Amplification by Stimulated Emission of Radiation) and parametric amplifiers have been developed. They are of very great importance, especially for the amplification of very weak microwave signals in radio astronomy and satellite communications. More recently, an optical system known as the "Laser" has extended the coherent electromagnetic spectrum into the visible frequency range and opened a host of new applications.

Microwave Spectroscopy of Gases

As one progresses toward higher and higher frequencies, interactions between electromagnetic waves and molecules or atoms become increasingly important. From quantum mechanics it is known that

H. H. Klinger's primary interest is the study of problems associated with the generation and amplification of extremely short waves adn with their applications in research. He also has deep interest in the field of radio astronomy. Klinger, a member of the research staff of the laboratories of Battelle Institut, in Frankfurt, Germany, is author of numerous papers based upon his studies in those fields.

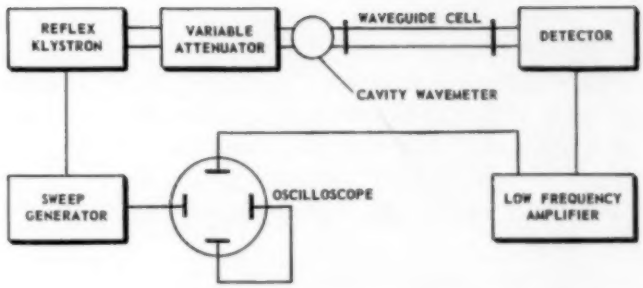
atoms or molecules may absorb or emit energy in discrete quantums given by the quantum relation

$$E_2\text{-}E_1 = hf$$

where f is the frequency of the quantum, h is Planck's constant, and E_2 and E_1 are the total energies of the atom or molecule before and after emission of absorption of the quantum. In the microwave region the quantum energy of a frequency of 30 kilomegacycles per second (a wavelength of 1 cm) is $hf = 1.24 \times 10^{-4}$ eV. Although this quantum is very small in comparison with light frequencies, it is of the same order of magnitude as the lowest energy levels in a molecule or atom. If microwaves having a wavelength of this order are transmitted through a gas, energy is absorbed from the radiation at frequencies corresponding to the above quantum relation.

The diagram of a simple microwave spectrograph is shown in Figure 2. The microwaves are generated in a reflex klystron, travel through a waveguide containing the gas to be investigated, and are received by a crystal detector. As a rule, the gas is at a very low pressure and isolated from the atmosphere. The frequency of the microwaves travelling through the gas can be varied by altering the voltage applied to the reflex klystron. If the gas absorbs some particular frequency, the power at this frequency will be diminished as it is transmitted through the waveguide and will be indicated by a reduced voltage produced by the crystal detector. The reduction of voltage is observed on a cathode-ray oscilligraph. The oscillograph then shows directly a graph of the gas spectrum in the frequency region over which the reflex generator is being swept. The absorption frequncies can be measured to an accuracy of one part in 10^4 by using cavity-wavemeters and to an accuracy as great as about one part in 10^7 by comparing the microwave frequency with highly accurate quartz-crystal oscillators. Usually the absorption frequency of the gas is modulated by a high frequency (Stark-effect) field.

The absorption spectra of gases observed in the microwave region are mainly due to transitions between the neighboring rotational energy levels of the molecules and to hyperfine splitting of the absorption lines as a result of various nuclear effects. Study of hyperfine splitting, therefore, yields information about the nuclei present in the molecule. It is also possible to study by microwave spectroscopy the Stark-effect and the Zeeman-effect which takes place when rotating molecules are placed in a static-electric or a static-magnetic field. These effects cause a splitting of absorption lines from which it is possible to determine the molecular dipole moment and the magnetic moment of the molecule being investigated.



2. *Diagram of a simple microwave spectrograph. Microwaves generated by a reflex klystron travel through a waveguide containing the gas under study, and are received by a crystal detector. The oscillograph shows the absorption spectra of the gas.*

In contrast to infrared spectroscopy, where the rotational spectrum of the molecules of gases is superposed on vibrational spectra and is observed as a more or less continuous band, only one individual line is usually observed in the microwave region. Nevertheless, the resolution of a microwave spectrograph is higher than that of an infrared spectrograph by a factor of about 10^3 and this makes it possible to investigate in detail very small regions of the spectrum.

Paramagnetic and Ferromagnetic Resonance

Another important branch in microwave spectroscopy is paramagnetic and ferromagnetic resonance. According to the laws of atomic theory, the electrons of a paramagnetic ion possess a resultant angular momentum. When a static magnetic field H_0 is applied to charged spinning particles, they will precess about the direction of the field with a precessional frequency given by

$$hf = 2\mu H_0$$

where μ is the magnetic dipole moment of an electron known as the Bohr magneton. It is convenient to remember that this frequency is about 2.8 mc/sec per gauss. When a microwave-frequency magnetic field having a component at right angles to the static magnetic field is applied to the spins, they make a re-enforced precession. The amplitude of this re-enforced precession grows if the frequency of the microwave magnetic field equals the precessional frequency given by the equation above. This will be observed as a resonance absorption in the microwave region. By means of the paramagnetic resonance spectrometer operating on the principle described above, it is possible to permit accurate nondestructive analyses of biological systems, chemicals, semiconductors, and metallic ions. Further applications include also poly-

merization, radiation damage, and photosynthesis.

Similar resonance absorptions occur in ferromagnetic materials. Ferromagnetic resonance has become of great technical importance in connection with the development of nonreciprocal microwave ferrite components, such as isolators and circulators, which permit microwave energy to be propagated only in one direction.

Microwave spectroscopy is today one of the most important tools for studying matter in solid and gaseous states.

Microwaves and Plasma

A great deal of interest is attached to the interaction between microwaves and a gas-discharge plasma. The study of microwaves penetrating through an ionized gas permits the determination of the electron density, temperature, and drift velocity of the plasma, as well as the dielectric and magnetic properties of ionized gases. These investigations are of great interest also in gathering data about the ionosphere and outer space. Moreover, in controlled-fusion research microwaves can determine the properties of plasma at extremely high temperatures.

The electromagnetic properties of plasma in ionized gases were studied a long time ago by means of the classical magnetoionic theory. Many of these phenomena occurring in plasma can also be found in solids at microwave frequncies in the presence of a magnetic field. Because of the nature of crystalline solids, magnetoplasma effects are enriched by added complexities associated with the symmetry and band structure of the crystals. Other particularities arise from the dielectric properties and the greater electron densities which may vary in a semiconductor from 10^6/cc to that of $10/^{22}$ for metals. Plasma effects in solids have been observed, of course, at microwave frequencies, including magnetoreflection, cyclotron resonance, and the Faraday effect. These investigations are important in measuring the fundamental parameters and properties of semiconductors and metals associated with holes and electrons in these materials.

More recently, amplification of microwaves, which is obtained by interaction between an electron beam passing through a plasma and slow waves in the plasma, has become of increasing interest not only for microwave techniques but also to obtain a better understanding of radio waves emitted from atrophysical objects.

Microwaves and Radioastronomy

One of the most important discoveries in science is the radiofrequency radiation from cosmic sources. Although this discovery was made over 30 years ago, the significance of cosmic radio waves has been recognized only during the last decade. The essential progress in radio astronomy, as this science is called, has followed the rapid technical developments in microwave techniques since World War II.

To detect the weak radio signals from extraterrestrial sources a directive antenna and a highly sensitive radio receiver must be used. In the microwave region a single or a group of parabolic antennas are used as a directive antenna system, while the receiver is frequently a microwave radiometer. In this type of receiver, the inherent receiver noise is compensated by comparing the noise power received from the antenna with the noise power from an attenuator inserted in the antenna waveguide line. Much progress in the detection of very weak extraterrestrial microwave signals has recently been obtained by using solid-state masers and parametric amplifiers.

There are many sources of radiofrequency radiation in space exhibiting characteristics similar to those of thermal noise. Our sun, for example, radiates in the whole spectrum of electromagnetic waves. Microwaves from the sun originate primarily from the inner corona and the chromosphere. Measurements of solar micro-

3. *A microwave apparatus for studying the optical nature of electromagnetic radiation. The apparatus consists (left to right) of a modulated klystron transmitter with parabolic antenna, a lens, and a receiving system.*

wave radiation yield information on the electron density and the electron temperature in the solar chromosphere. Besides this radiation from the "undisturbed" or "quiet" sun, enhanced microwave radiation from the neighborhood of sunspots is observed. This type of solar radiation shows a close correlation with the sun-spot area and with the ionization of the E-layer of the earth ionosphere, which is produced by soft X-rays emitted from the same sources and from which enhanced microwave radiation is also emitted. In addition, sudden increases in microwave intensity, known as "bursts" and "outbursts" which are frequently due to "flares", are observed. The occurence of an outburst in the microwave region is, as a rule, coincident with the appearance of a sudden ionospheric disturbance known as the "Mögel-Dellinger" effect. By using microwave-interferometer antenna systems, it is possible to localize and investigate the discrete microwave sources on the sun.

Since the microwave radiation from the quiet sun and also the enhanced radiation from the disturbed sun are of a thermal nature, it is likely that the "bursts" are generated by plasma oscillations in the sun's atmosphere and the "outburst" possibly by synchrotron radiation from very fast electron beams deflected by solar magnetic fields.

Radio waves originate also in other cosmic sources, such as supernovae and colliding galaxies, known as "radio stars". Of particular importance to astronomy is the 21.1-cm wavelength radiation from interstellar gas. This is, thus far, the only line observed in the spectrum of cosmic radio waves. It originates from an interaction between the electron spin and the magnetic momentum of the proton in the hydrogen atom. By measuring the Doppler shift of this microwave line it is possible to investigate the movement and distribution of interstellar gas clouds in various galaxies.

Other cosmic sources which produce radio waves are the planets, such as Venus and Jupiter. Radiation from these sources, however, is extremely weak in the microwave region. As a matter of fact, the detection of these weak signals was made possible only recently by using maser radiometers.

Microwave and Optics

Remarkable progress has been achieved in the application of microwaves in experimental physics. Because the wavelengths of microwaves are comparable in magnitude with the geometric dimensions of the laboratory apparatus used, the optical properties of electromagnetic radiation such as interference, reflection, refraction, diffraction, and polarization can be simply demonstrated. Figure 3 shows an optical microwave apparatus for 3-cm wavelength used in those experiments. It consists of a reflex klystron and a transmitter with parabolic antenna and modulator, a receiver arrangement, and a microwave lens. In addition, corresponding experiments with sound waves and microwaves are of great interest for a deeper insight into wave propagation phenomena in electromagnetic theory as well as in acoustics.

Further Applications

There are many more applications of microwaves which cannot be discussed in this paper. The important part which microwaves have begun to play in physics during the last few years is to be ascribed primarily to the accuracy of microwave measurement techniques. Whereas 30 years ago length determinations were the most accurate laboratory measurements, much more accurate measurements are now possible by determining time and frequency by microwave and related techniques. It is possible that microwave radiation could be used continuously to measure the distance of a satellite in order to determine an accurate orbit for both the earth and the satellite.

An outstanding accuracy is possible in obtaining continuous range information accurate to a fraction of a wavelength. In addition, artificial satellites orbiting the various planets of the solar system could give very accurate values for many of the parameters of the solar system.

The increased accuracy of microwave atomic clocks makes possible, for the first time, an experimental investigation of a number of fundamental cosmological problems related to gravity and relativity.

In this paper the important application of microwaves in radar, communications, industrial heating, and computer techniques have not been discussed. Although these applications are well known today, some progress might be expected in the near future by extending the application of microwaves into the millimeter and submillimeter wave range.

Rating Personnel Performance Effectively

As organizations grow in size and complexity, employee-evaluation techniques take on greater importance. This article reviews better-known techniques and takes a look at some newer concepts

by JOHN R. STOCK

NOT MORE THAN A HALF-CENTURY ago it was possible for the owner of a firm or the administrator of a governmental agency to have an intensive knowledge of the work performed by all the people in his employ. Based upon his immediate knowledge of their job performance, he was able to make a comparative evaluation of his employees. Thus, promotion, transfer, or dismissal of an employee was initiated and executed by the owner or administrator after little or no consultation with associates or subordinates regarding his decision. If, because of an error in evaluation, the decision proved to be a poor one, it was "chalked up" to experience. During this era of the one-man administrative organization, it was possible for the administrator to make numerous erroneous decisions without jeopardizing his position.

The subsequent growth in size and complexity of business and governmental organizations has made it impossible for one person to know even the key people in an organization. In large organizations the authority for making personnel decisions has been delegated to many people. Furthermore, the methods of mass production and increased efficiency of operation have greatly reduced the allowable margin for personnel decision errors. Therefore, one important factor in the continued existence of an organization is sound administrative judgments in the area of personnel decisions. To a great extent the soundness of these judgments is determined by the accuracy and objectivity of the employee-performance information available to the administrator. The development of methods for providing such performance information has held the interest of a great many applied psychologists over the past four decades.

Early investigators in the area of performance

A THEORETICAL EQUATION OF RATING

Rating-scale designers have formulated theoretical equations which serve as guides in constructing rating scales. Though there is a similarity between equations generally, each usually reflects the theoretical orientation of its designer. The example presented here was developed by Robert J. Wherry of the Ohio State University. The plus signs in the equations are used simply as connectives and the property of additivity is not implied. The development of the equation is as follows:

1. $R = f(0 + P)$
2. $P = f(A + I + e_p)$
3. $0 = f(A + I + BP_{oa} + BP_{ar} + e_p + e_o)$
4. $R = f(A + I + BP_{oa} + Bp_{ar} + BR_{oa} + BR_{ar} + e_p + e_o + e_r)$

Including the volitional behavior of the rater, the rating equation becomes:

5. $\text{Rating} = f(A + I + BP_{oa} + BP_{ar} + BR_{oa} + BR_{ar} + e_p + e_o + e_r + BC + SP)$

The variables presented are defined as follows:

- R = Recall of the observation of the performance
- 0 = Observation of the performance
- P = Performance being rated
- A = Individual's true performance
- I = Environmental influences
- e_p = Performance error component
- BP_{oa} = Over-all perceptual bias
- BP_{ar} = Areal perceptual bias
- e_o = Error of observation
- BR_{oa} = Over-all recall bias
- BR_{ar} = Areal recall bias
- e_r = Error of recall
- BC = Conscious bias
- SP = Social pressure

evaluation quickly discovered that for most jobs it was not possible to develop units of production as a criterion of performance. Further, they discovered that in many situations, where well-defined units of production were used as a criterion, the performance scores were not true indicators of employee worth to the organization. An illustration of this fact is the employee who, though he produced the most units, so disturbed other employees with his constant bickering that he caused a loss in over-all production. As a result of these early findings, the value of production units as a criterion of performance has been questioned, and other criteria have been developed. The most popular and most widely used of these is the performance rating. It is the purpose of this paper to present an analysis of the rating process, and to describe and discuss some of the rating scales employed.

The Rating Process

The many variables entering into the rating process can be categorized as they relate to different aspects of the total process. Thus the variables which directly affect the performance situation include heating, lighting, and humidity. The effectiveness of raters is affected by such variables as over-all severity or leniency of rating, disposition toward the individuals being rated, and proficiency in recall of details. In order that all aspects of the rating process be considered, it is convenient to think of the total process as consisting of three chronological subprocesses: The performance being rated, the observation of the performance by the rater, and the recall of the observation.

The validity of an individual's rating depends upon his true performance, the effects of environment on the individual during the rating period and the error component produced by chance variation at the time. The true performance is what the rater wishes to evaluate, but the environmental influences and the error component always enter into the evaluation. Environmental influences that might affect the performance of the individual being rated are lighting, heating, humidity, and distractions. Examples of the performance-error component would be the day-to-day variation in the individual's performance and his motivation at the time. A large number of performances is necessary to average out the error component. Therefore, to approximate the individual's true performance accurately, the effect of environmental influences must be controlled and the individual must be given a large number of opportunities to average out the performance error.

The value of the rater's observation is determined by his opportunity to observe and by how exactly he observes. The exactness of an observation depends upon how accurately the rater approximates the individual's true performance, for at this point perceptual bias may enter into the process. Some raters see only the things that are done well, while others see only the things that are done poorly. This type of bias may be of an over-all nature; or, it may be areal, that is, determined by preconceived notions about the specific individual being rated. Error of observation also enters into the process. An example of this would be the misinterpretation by the rater of what he observed.

Errors of observation may be reduced by teaching the raters what to look for and by training them to guard against common observational errors. The effects of perceptual bias may be averaged out by having the performance of a particular individual evaluated by more than one rater.

The recorded rating for an individual is based upon the rater's recall of the individual's performance. The process of recall is influenced by over-all biases of recall, areal biases of recall, and errors of recall. The over-all bias of recall is dependent upon the rater's general approach to all individuals being rated, without regard to their actual performance. The areal bias of recall results from the rater's disposition toward a particular individual being rated. The error of recall results from memory distortion of the specific incidents that occurred during the observation of performance. The dropping out of details over a period of time increases the error of recall.

The biases of recall tend to be decreased if a number of raters observe the performance of the individuals at the same time. The errors of recall may be reduced by giving the rater several opportunities to state his

The author is a member of the Institute's human factors group. He has participated in research on the design and evaluation of aural reading machines for the blind; and he is currently conducting studies looking to the validation of a battery of tests designed to aid in the selection of research scientists and engineers. Prior to his association with Battelle, John Stock was engaged in the development of personnel selection and placement techniques for municipal government. A graduate of Duquesne University with a B.A. degree in psychology, he received his M.A. degree in industrial psychology from the Ohio State University.

opinion of what occurred, thus permitting greater elaboraton of detail. All of these sources of recall error may be reduced if the raters take detailed notes immediately after observation of the performance.

The rating process as described does not take into account the volitional behavior of the rater. Therefore, to complete the analysis, two further variables, conscious bias and social pressure, must be added. Conscious bias is manifested in ratings that are wilfully distorted by the rater as a result of his feelings for the individual being rated. The effect of social pressure is exemplified by the timid supervisor who rates all subordinates high because he would not want it known that he said anything derogatory.

Behavior Trait Scales

The rating scales developed to date fall into two major categories: the behavior trait scales and the behavior statement scales. Examples of the behavior trait scales are the yes - no, graphic, and adjectival scales. These scales involve evaluation, that is, the assignment of values by the rater.

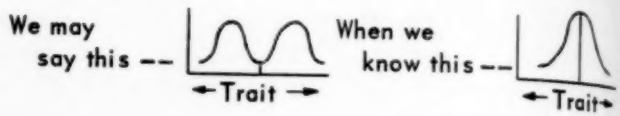
Yes - No Trait Scale

The earliest form of rating scale developed was the yes - no trait scale. This scale contains a list of behavior traits which are to be checked either affirmatively or negatively as they describe the behavior of the individual being rated. Here is an example of part of a yes - no trait scale.

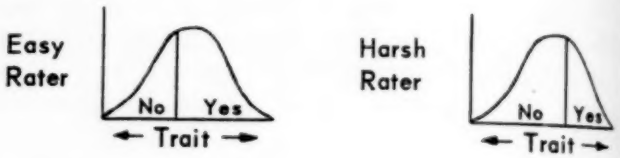
	Yes	No
1. Honesty	☐	☐
2. Efficiency	☐	☐
3. Productivity	☐	☐
4. Cooperativeness	☐	☐
5. Emotional Stability	☐	☐

This form of scale is one of the most widely used because it is simple to construct and easy to administer. Raters do not have to be trained to use this scale. However, it has many shortcomings, the most important of which are:

1. It is assumed that persons can be separated into into two types for a given behavior trait. That is,



2. If it is accepted that this typology does not exist, then the rating is based upon a variable dichotomy, i.e., the yes - no cutting point will change as a function of the leniency or harshness of the rater.



3. Not only is the limit on the yes - no distribution undefined, but the trait distribution is undefined; i.e., the raters are not employing the same trait definitions.
4. This form encourages the intrusion of unconscious bias—perceptual, observational, and recollective.
5. It encourages conscious bias.
6. It results in ratings affected by social pressure.

As was stated previously this form is still used despite its many shortcomings.

Graphic Trait Scale

The graphic trait scale was a natural development from the yes - no trait scale brought about by the objection of raters who found it difficult to classify persons into yes - no groups. The typical graphic trait scale contains a list of traits, each trait name followed by a segmented line. A numerical or adjectival value is assigned to each segment in an ascending or descending order. The segmented line represents the trait distribution continuum. The rater describes the performance of an individual by marking the segment on the trait continuum. Several items which might be included in a typical graphic trait scale are shown at the top of page 11.

The graphic trait scale is the most widely used of the rating scale forms. Its obvious advantages are its simplicity of construction and its ease of administration. This form is superior to the yes - no scale in that it is not based upon a variable dichotomy. However, the cutting point or segment values on the scale are still subject to rater interpretation. Furthermore, the

1. Honesty

0	25	50	75	100
Extremely Dishonest		Fairly Honest		Extremely Honest

2. Efficiency

0	25	50	75	100
Extremely Inefficient		Fairly Efficient		Extremely Efficient

3. Productivity

0	25	50	75	100
Extremely Non-Productive		Fairly Productive		Extremely Productive

other shortcomings of the yes - no trait scale have not been corrected in this scale.

Adjectival Rating Scale

The most refined of the trait scale forms is the adjectival rating scale. This form usually contains a list of trait names followed by a segmented line with groups of short statements, or behavior-grams, defining each of the segments. Each behavior-gram contains descriptions of specific bits of behavior. The rater is to assign the person being rated to the specific behavior-gram for the particular trait. Several typical items of an adjectival scale are shown below.

This form incorporates the advantage of the graphic trait scale in that the trait is measured along a continuum, and, in addition, it overcomes the problem of subjectivity of definition and intrusion of unconscious bias through the use of specific behavior statements. However, it does not remove the effects of conscious bias or social pressures. Futher, it is probable that when the behavior-grams contain highly specific statements of behavior, as they should, the characteristics of each person being rated will be found in each behavior-gram, proving that behavior cannot be defined by broad categories called traits.

Behavior Statement Scales

The behavior-check-list, critical-incidents, and forced-choice scales are examples of the behavior-statement-scale category. These scales involve description, that is, a designation of occurence or non-occurence of specific behavior.

Check-List Rating Scale

The first of the behavior-statement scales developed was the check-list rating scale. This form was introduced in the early 1930's and was developed in conjunction with local civil service organizations for the evaluation of civil service employees. The typical behavior check-list rating scale contains between 100 and 150 statements describing specific observable behavior. An illustration of such a scale is shown at the top of the following page.

The rater is required only to state whether or not he has observed the occurrence of the behavior described with regard to the person being rated. This scale differs from the behavior-trait scale in two respects: (1) it abandons the trait classifications and replaces them with specific observable behavior statements, and (2) it no longer requires evaluation by the rater, but rather requires only a report of occurrence or nonoccurrence of specific behavior. This form eliminates three weaknesses of the behavior-trait scales. It eliminates ambiguity of definition by replacing trait names with statements of behavior. It eliminates the problem of cutting-point definition by requiring a statement of occurrence rather than an evaluation. And it reduces the effect of unconscious bias by making the behavior descriptions very specific. Although this form was a significant advance in technique, it did not correct the problems introduced by conscious bias and social pressure. Moreover, raters have objected to the length of this type of scale because it usually contains 100-150 items as compared to the 5 - 10 items of the adjectival

1. Honesty

Low — High

Lies habitually. Cheats at cards. Pilfers items from stores. Disregards business ethics. Violates a confidence.

Always truthful. Plays fair at cards. Never steals. Observes business ethics. Maintains a confidence.

2. Efficiency

Low — High

Wastes work materials. Always behind schedule. Work area is always cluttered. Always does a job the hard way.

Conserves work materials. Always ahead of schedule. Devises time-saving methods. Keeps a well arranged work area.

	Rater 1	Rater 2
Talks too much	☐	☐
Too blunt or outspoken	☐	☐
Too much self-importance	☐	☐
Good team worker	☐	☐
Not a good team worker	☐	☐
Resents criticism or suggestions	☐	☐
Antagonizes when dealing with others	☐	☐
Might often be more considerate	☐	☐
Usually pleasant and cheerful	☐	☐

or graphic scales. However, it has been determined that it actually takes about the same time to complete both types of scales.

Critical-Incident Scale

The critical-incidents scale contains a check list of actual incidents which have occurred during the rating period. The check list of critical incidents is developed by observing the behavior of employees when some event occurs which produces either success or failure of a specific operation on the job. After a large sample of these critical incidents has been recorded, a check list of statements describing these incidents is developed. The check list contains an equal proportion of statements describing the critical incidents leading to both success and failure. Here is an example:

ESTIMATING AND SUPPLYING PROJECT NEEDS

Positive–

....1. Outlined and scheduled personnel needs.

....2. Scheduled facilities and equipment for use by several groups.

....3. Had supplies available when needed.

....4. Developed a system facilitating procurement of supplies.

Negative–

....1. Submitted plans with vague steps and time estimates.

....2. Made erroneous estimate of personnel needs.

....3. Failed to request facilities via proper channels.

....4. Failed to reorder stock in time for use.

The critical-incidents scale improved upon the behavior check-list rating scale because only those items that were known to describe behavior leading either to success or failure of performance were contained in this scale. However, it did not eliminate the problem of unconscious bias and social pressure, since the rater was still at liberty to determine what was recorded. Although this instrument is expensive to develop, the cost is offset by the increased validity of results yielded by a well-constructed critical-incidents scale.

Forced-Choice Scale

The forced-choice scale was developed as an instrument designed to remove the effects of conscious bias and social pressure in the rating situation. The forced-choice scale is composed of groups of statements describing specific behavior, each group containing two to five statements. The scale has been developed so that paired statements in each group appear to be either equally favorable or equally unfavorable with regard to how well someone would prefer this statement to be made about them. In each group of statements the rater is to mark the one statement that best describes the behavior of the person being rated and the statement which least describes the behavior of the person being rated. Hence, the rater is "forced" to choose between statements which appear to be equally favorable. The forced-choice scale usually contains 25 to 50 two-to-five statement groups as shown below:

Block 1

Most	Least	
☐	☐	Has a "never-say die" attitude toward setbacks
☐	☐	Will not complete a report if research is required
☐	☐	Knows use and purpose of methods and equipment
☐	☐	Does not take any interest in technical reading

Block 2

Most	Least	
☐	☐	Does not like to do routine work
☐	☐	Learns new technical work very rapidly
☐	☐	Thinks writing reports just another pleasant chore
☐	☐	A "self-starter" on routine work

The forced-choice scale has, supposedly, incorporated the advantages of the behavior-statement check-list and, in addition, has eliminated the effects of conscious bias and social pressure. This form, however, is expensive to develop, but, as in the case of the critical-incidents scale, the increase in validity should make the investment worthwhile.

SELF EVALUATION

In recent years, several investigators working in the area of personality measurement have developed forced-choice scales which permit an individual to rate himself on certain personality characteristics. Although the research findings are too limited to be conclusive, the results obtained by this self-rating forced-choice

technique strongly indicate potential for a high validity of measurement. The self-rating forced-choice technique has not yet been employed in the evaluation of employee performance, but, theoretically, it should yield the most valid results attainable with our present techniques. This statement is based upon the following three hypotheses:

1. A well constructed forced-choice scale reduces the effects of over-all and areal perceptual biases, conscious bias, and social pressure.

2. An individual rating himself, because of an immediate knowledge of his performance under many conditions, will give a more valid rating that reflects a reduction in the effects of environmental influences, performance errors, and observational errors.

3. The effects of over-all recall biases, areal recall biases, and recall errors will be reduced in a self-rating scale because of the individual's ability to draw upon a detailed store of information regarding past performance.

These hypotheses do not imply that the self-rating forced-choice technique will reduce the effect of self-evaluative variability. However, the hypothese contend that this effect is less than the effect introduced by other rating techniques.

Thus, it is possible that in the near future an administrator may utilize employee performance information reflecting the unique interests of management, first-line supervision, and the employee. This could be achieved through the use of combined ratings, selected portions of which would be executed by a management representative, a first-line supervisor, and the employee, respectively. The administrator would then be aware of the performance picture as viewed at all levels in the organizational hierarchy.

Future Research

In the past, research on rating scales has followed an empirical iterative approach; i.e., an experimental rating scale was constructed and was repeatedly "tried out" and modified until it met a given standard in predicting some external criterion. The emphasis in this procedure was placed upon over-all results in a specific application of the rating scale, with little or no regard for the individual variables involved in the process. But several recent investigations, by use of techniques developed by the social psychologists for studying small groups, have shown that the variables in the rating process can be isolated and manipulated in an experimental situation.

In one of these investigations, individuals performed identical tasks while assigned to different group teams. An individual's performance was rated by the other members in each group team and by an observer who moved with him from group to group. In this way it was possible to study: (1) the changes in group member ratings as a function of group frames of reference with task performance held constant, and (2) the changes in observer ratings as a function of observer frames of reference. Because of their exploratory nature, these investigations yielded little scientific information. They did, however, validate the methodology necessary for controlled rating experimentation.

The tools are now available for the design of research programs in which each hypothesized variable in the theoretical equation defining the rating process may be modified systematically, either independently or in combination with other variables. In this way, the limits of each variable and the functional relations between them may be determined, thus making possible their quantification. Quantified variables would pave the way for construction of performance rating scales that should yield results as valid and reliable as school grades, intelligence test scores, meteorological predictions, and similar data.

"We have entered a new era, an era of scientific revolution, as C. P. Snow terms it, in which science and technology are transforming our way of life and the relations between nations. As practicing scientists, we cannot stand aside and simply watch this process, regardless of where it takes us; we must and we can use science and technology to achieve the humanistic goals of our free society. Let us learn to take greater advantage of the opportunities science offers us to contribute to the striving for peace in international relations and to improve the lot of man throughout the world."

G. B. Kistiakowsky, Special Assistant to the President (of the United States) for Science and Technology.

NOTES from BATTELLE

* RARE EARTHS IN SEMICONDUCTORS

Recent research has shown that rare-earth compounds of the elements of Groups V B and VI B of the periodic table are semiconductors. The development of these semiconductors to a useful state would greatly increase the number available to electronic technology, point out James F. Miller and Richard C. Himes, of Battelle. In the case of sesquitellurides alone there are more than a dozen possibilities for semiconducting compounds.

The Battelle technologists state that the gradation in chemical properties and atom sizes from element to element in the rare-earth series suggests that a similar gradation may exist in the electrical properties within a given class of compounds. Indeed, the hypothesis has been borne out in experimental results from studies of a number of compounds that have been conducted under their guidance. Exploratory work has been concentrated especially on compounds of the rare-earth elements with antimony, bismuth, selenium, and tellurium.

* IMPROVING LEATHER FINISH

Improvement in the properties of leather is a continuing concern of leather manufacturers. A new process, which greatly improves wear and finish characteristics without sacrificing other qualities of leathers, was recently announced. It has been termed the first major advance in leather finishing in almost 30 years.

The new urethran-polymer treatment was developed in a cooperative research program at Battelle, under the direction of Maynard B. Neher. The new compound is applied to leather after it has been buffed, but before the finish is applied.

A number of advantages are gained from use of the new compound. Treated leather has nearly eight times the scuff resistance of untreated leather. The formation of the fine ridges that usually result from repeated bending of leather is virtually eliminated, as determined by the Navy's Grainometer test. Use of the compound also inhibits bleeding of internal leathers into the final shoe finish, a quality important to leathers of pastel shades and to white leathers. The compound has application to leather products other than footwear.

Leather treated by the new development will be marketed by the Endicott Johnson Corporation. Other companies which cooperated in sponsoring the research at Battelle were: Beadenkopf Leather Company, W. D. Byron and Sons, Inc., Eagle Ottawa Leather Company, S. B. Foot Tanning Company, G. Levor and Company, and Pfister and Vogel Tanning Company.

* SURVEILLANCE AT SUGAR GROVE

The world's largest radiotelescope, now under construction at Sugar Grove, West Virginia, and officially known as the Naval Radio Research Station, has a 600-foot diameter parabolic antenna that can be rotated horizontally and vertically to track astonomical bodies. Drives and control systems of unprecedented size and complexity are required to move the telescope into position, aim it, keep it on course, and focus the incoming radio signals.

Under the terms of a recently signed contract, Battelle's responsibilities to the Navy with respect to the NRRS will be extended. The Institute now will provide major technical assistance during the design, construction, testing, installation, and checkout of the drives and control systems for the radiotelescope. The latest contract will provide the Navy with the engineering services necessary to ensure that the equipment suppliers meet performance specifications and that the systems operate compatibly with each other and with the telescope structure.

These systems include the load-carrying components that support the telescope structure; the mechanical components and their controls to maintain azimuth and elevation; a digital director system, which consists of a computer that directs the drive systems; a configuration control system that maintains the reflector in true parabolic shape as the steel framework deflects under various load conditions; a focal-feed control to maintain proper relationship between the surface of the reflector and the focal-feed point; and the operator's console.

Preliminary research and engineering design of all these systems was done by Battelle over the past four

years, working as a subcontractor to Grad, Urbahn & Seelye, who designed the telescope structure. Teams of Institute research specialists—principally electrical engineers, systems engineers, and mechanical engineers—designed the systems to meet performance specifications set up by the U. S. Naval Research Laboratory.

As the engineering phase is completed, the Navy's Bureau of Yards and Docks' prime contractor, Tidewater-Kiewit-P.E.C., lets contracts with suppliers for production and testing of the mechanical and electrical components of the telescope. Battelle's contract, also with the Bureau of Yards and Docks, calls for technical surveillance, i.e., interpreting specifications, monitoring design development performed by the contractor, appraising final designs, interpreting test procedures and analyzing test results, providing consultation during installation of the components, and aiding in the final checkout of the complete telescope system.

ELECTRON TUBE WELDING

The reliability of electron tubes is a matter of continuing concern in both military and civilian application. As part of a U. S. Army Signal Research and Development Laboratory program for study of tube reliability, Battelle welding technologists have been investigating factors that affect the reliability of welded connections in electron devices. In the first phase of the program, just completed, studies were conducted on the welding characteristics of metals (with emphasis upon molybdenum) now used or being considered for use in tube applications.

J. J. Vagi, William A. Gibeaut, Glen E. Faulkner, and Perry J. Rieppel point out that the factors that influence the reliability of resistance-welded joints of crossed wires are weld characteristics, material characteristics, welding conditions, inspection, and operating conditions.

Some of the findings from the research, with respect to molybdenum wire, are summarized below:

- Sound molybdenum cross-wire welds that are free from cracks and porosity, can be made within a reasonable range of welding variables.
- The most significant improvement in cross-wire welds resulted when nickel-foil inserts were used between molybdenum wires during welding. The noticeably improved strength of the welds is attributed to the mechanical reinforcement and to the reduction of notch effects.
- Experiments also disclosed that molybdenum cross-wire welds have higher strength in tension-shear than in torsion-shear, thus suggesting that bending stresses should be avoided in designs involving recrystallized molybdenum in weld heat-affected zones.

SOLUBILITY OF RARE EARTHS

That rare-earth additions improve the properties of some metals has been known for many years. Yttrium has been found recently to impart improved resistance to oxidation; but the lanthanide rare-earth metals have similar properties. There has been interest therefore, in their possible use also as additions for improving the oxidation resistance of chromium-iron base alloys. The solubility of the yttrium and rare earths (an important factor in the fabricability of alloys) in chromium and in chromium alloyed with 10, 25, 50, and 75 weight-per cent iron has been studied at 1260 C (2300 F) and at room temperature by Seymour G. Epstein, Martin Steven Farkas, and Arthur A. Bauer.

In research for General Electric Company's Aircraft and Nuclear Propulsion Laboratory, they determined that most of the elements appear to be soluble to 0.1 weight-per cent or less in the alloys. Dysprosium, erbium, and holmium exhibit solubility limits estimated at between 0.1 and 0.3 weight per cent. In general, the metallurgists found that solubilities decreased slightly from 1260 C to room temperatures.

The studies indicate that the solubility of additions is not necessarily a dependable guide to a material's contribution to oxidation resistance. Further studies will be required to determine the specific effect of each of the rare-earth metals, as additives, to the oxidation properties of chromium and the chromium-iron alloys at elevated temperatures.

TANTALUM AS AN ALLOY BASE

The need for structural materials at temperatures above 1100 C (2000 F) has led to consideration of tantalum as an alloy base. In spite of its high density, tantalum possesses the advantages of a very low ductile-to-brittle transition temperature, a refractory oxide, and high melting point.

As part of a broad investigation on the strength and oxidation properties of tantalum for the Materials

Laboratories, Wright Air Development Division, William D. Klopp, Daniel J. Maykuth, and Robert I. Jaffee explored the effects of alloying on the oxidation behavior of tantalum. This research led to the following conclusions:

1. The most effective binary additions for improving tantalum oxidation at 1000 to 1400 C are the Group IV A elements titanium, zirconium, and hafnium. Moderate improvements result from adding vanadium, columbium, chromium, molybdenum, tungsten, silicon, boron, iron, and nickel.

2. Depth of subsurface contamination hardening of tantalum is significantly reduced by thorium, silicon, vanadium, titanium, and tungsten. Excepting vanadium and tungsten, these elements form oxides which are more stable than tantalum oxide, resulting in formation of an internal oxide dispersion.

3. Oxidation behavior of tantalum ternary alloys investigated was about an average of the behavior obtained when the same elements were added as binaries.

4. The oxidation behavior of tantalum alloys could be correlated with the ionic radius of the addition and with properties of the oxide of the addition element.

5. The effects of alloy additions on contamination behavior of tantalum could be correlated with thermodynamic oxide stability, atom diameter, and melting point of the alloy additions.

* Battelle staff members recently named to technical posts include: *C. Malcolm Allen*—member, Program Organization Committee for the Semiannual Lubrication Symposium, American Society of Mechanical Engineers; *Benson G. Brand*—member, Editorial Committee, Committee D-1 on Paint, Varnish, Lacquer, and Related Products, American Society for Testing Materials; *Hall Cary*—member, Administrative Committee, The Professional Group on Reliability and Quality Control; *Herbert N. Johnston*—chairman, Subcommittee on Coatings and Impregnations for Corrugated Board, Technical Association of the Pulp and Paper Industry; *Orval L. Linebrink*—director, Measurement Standards Division, Instrument Society of America; *H. W. Lownie, Jr.*—chairman, Subcommittee 6 on General Castings, Committee A-3, ASTM; *Howard G. Shutz*—member, Steering Committee for the Formation of New Committee E-18 on Sensory Evaluation of Materials and Products, ASTM; *Oscar F. Tangel*—chairman, Papers and Publications Committee, Minerals Beneficiation Division, American Institute of Mining, Metallurgical, and Petroleum Engineers; *John Varga, Jr.*—member, Task Group on Reference Radiographs for Thin Wall Steel Castings, Committee E-7, ASTM.

* Rhenium's high melting point (3180 C) and boiling point (5900 C) make the metal interesting because of the unique surface properties it offers when plated on other metals. In a study for the Air Force Cambridge Research Center, Battelle technologists G. Stephen Root and John G. Beach sought to produce ductile rhenium-plated tungsten wires. They found that rhenium can be electroplated efficiently under the following conditions: use of a nickel cathode surface; an ammonium perrhenate-sulfuric acid bath containing ammonium nitrate; a bath temperature of about 90 C; and current densities of 18 amp/sqdm or more.

Root and Beach report that rhenium-plated tungsten wires, when heated above the recrystallization temperature for tungsten, are more ductile than unplated tungsten wire.

* The *Proceedings of the Propellant Thermodynamics and Handling Conference,* which met at the Ohio State University in July, 1959 was recently published by the University's Engineering Experiment Station. The volume, edited by Loren E. Bollinger of the University and Alexis W. Lemmon, Jr., of Battelle, contains papers devoted to the detailed consideration of many problems in jet propulsion and astronautics. The Conference was jointly sponsored by the University's Department of Aeronautical Engineering, the American Rocket Society, and Battelle.

* To be honored for their research achievements: *Dr. Walter Siegfried,* of Battelle-Geneva, who this month receives the REAUMUR Medal of the Société Francaise de Metallurgie for research that has "important consequences in the field of ferrous metallurgy".

Dr. Charles L. Faust, of Battelle-Columbus, who will receive the Scientific Achievement Award of the American Electroplaters' Society, for accomplishments "in advancing the theory and practice of electroplating, metal finishing, and allied arts; in raising the quality of its [the industry's] processes and products; and in enhancing the dignity and status of the profession".

Writings by STAFF Members

Journal of Applied Physics, v. 31, May, 1960, contains the following writings by staff members:

High-Temperature Hall Coefficient in GaAs. L. W. Aukerman and R. K. Willardson, pp. 939-940.

For three GaAs samples the increase in resistivity with increasing temperature is consistent with the expected temperature dependence of the decrease in mobility of the light mass electrons and the reduced mobility of the electrons excited to the upper minimum. The effect of interbrand scattering on the mobility of the light mass electrons in the lower minimum does not appear to be significant. This is in contrast to the case where pressure is used to change the positions of the minima so that they approach each other and give a minimum average mobility when the minima are at equal energy. When deep energy levels which are not completely ionized at 500 K or above are present, analysis of Hall effect vs. temperature in the usual manner may be either onfusing or misleading.

Effects of Directional Ordering on the Damping of Zone-Melted Iron. R. E. Maringer, pp. 229S-230S.

Damping measurements (1-2 cps) were made as a function of temperature and time on zone-melted high-purity iron, to which carbon or nitrogen have been added. Measurements were made with and without a magnetic field to isolate the magnetoelastic contribution to the damping. Two principal effetcs exist. These are a distortion of the Snoek peak and a time-dependent decrease in damping, which has been called the "magnetoelastic aftereffect". Magnetoelastic aftereffect data for zone-melted iron, containing carbon, were analyzed and shown to yield relaxation times in good agreement with those expected on the assumption that the effect is controlled by the interstitial diffusion of carbon.

Mining Engineering, v. 12, August, 1960, contains the following writings by staff members:

Beneficiation of Rock Salt at the Detroit Mine. Mineral Separation by the Thermoadhesive Method. W. C. Bleimeister and R. J. Brison, pp. 918-921.

The installation and operation of a 500-tons-a-day plant at the International Salt mine is described. Engineering details of the equipment are illustrated, The plant is flexible in that it can be adjusted to produce either a substantially improved rock salt (98% NaCl) with a high recovery of salt or, conversely, a higher quality rock salt (99% NaCl) at lower recovery. Product quality and costs are considered.

Development of a Thermoadhesive Method for Dry Separation of Minerals. R. J. Brison and O. F. Tangel, pp. 913-917.

This new system, specifically aimed at the beneficiation rock salt, is based on salt's ability to transmit radiant heat. The particles are fed over a belt coated with a heat-sensitive substance so that the warm impure particles would adhere preferentially to the coating. Desribes the course of the project from selection of the heat source through the design of a separator of pilot-plant size. Other possible applications and variations are cited where this process may enjoy similar success.

Proceedings of the Propellant Thermodynamics and Handling Conference, June, 1960, Engineering Experiment Station, Ohio State University, Columbus, Ohio, contains the following writings by staff members:

Research Researched. Edward E. Slowter, pp. 389-396.

In spite of all of the intangibles, uncertainties, guesses estimates, and other complicating elements, all research programs must undergo repeated evaluation. The important point is to select the most useful yardstick for the kind of research activity being evaluated and for the time at which it is bein gevaluated. The first evaluation should be made before any work is done, and further evaluations should be made during the course of the work, or until it is completed or teminated. As the work proceeds the accuracy of the evaluations should increase and action must be taken on the results of these evaluations. While formulas, check-lists, profit analyses, and other semi-quantitative guides may be helpful, they do not replace or substitute for sound judgement; in fact, in many cases, they will be inapplicable, and the intuitive, qualitative judgment of experienced men will be the sole basis of a "yes-or-no" decision. One final point should be equally clear; if no funds are invested in research, there will not even be the possibility of deciding whether or not certain courses of future action will be profitable or useful.

Materials of Construction for Handling Fluorine. Earl L. White and Frederick W. Fink, pp. 161-181.

No material is completely inert to attack by this element, but the handling of either liquid or gaseous fluorine is not nearly as much of a problem as was once believed. The sensitive elements Si, V, Re ,and U are attacked even below room temperature. Metals which can be used with liquid fluorine are Ni and nickel alloys, stainless steels, Al, Mg, mil dsteel, Ti, Ta, and Zir. The fluorocarbons are the only organic materials of general application.

Materials in Space. Frederick L. Bagby. Paper from *Advances in Space Science*, v. II., 1960, Academic Press, New York, pp. 143-213.

Discusses selection criteria, applications, and future outlook of materials for high temperature service, lightweight pressure vessels, mechanical elements and devices, thermomechanical power systems, solid state electronic devices, instrumentation, and personnel equipment.

Apparatus for the Study of Fission-Gas Release From Fuels During Postirradiation Heating at Temperatures up to 1600 C. Russell H. Barnes and Duane N. Sunderman. U. S. Atomic Energy Commission, BMI-1453, July 22, 1960, pp. 12. (OTS $0.50)

Xenon and krypton fission gases escaping from a small specimen during heating at constant temperature are measured using a continuous radioactivity monitor and charcoal adsorption traps. Helium carrier gas is purified by activated alumina, Cu, and Zr traps, and the 0 and moisture contents of the gas are monitored continuously. The operating procedure and data are presented for a typical heating experiment.

Hall Coefficient and Magnetoresistance in Semiconducting Diamond. R. T. Bate and R. K. Willardson. *Physical Society, Proceedings*, v. 74, 1959, pp. 363-367.

The Hall coefficient and transverse magnetoresistance of two type II-b semiconducting diamonds (p-type) were measured as

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a function of magnetic field from 500 to 20,000 gauss at fixed temperatures between 0 and 100 C. These diamonds have Rσ values of about 1000 $cm^2v^{-1}sec^{-1}$ at roo mtemperature. The Hall coeffiicent increases monotonically with increasing field, the total variation being about 10%. This behavior is similar to that which has been reported for p-type silicon at liquid nitrogen temperature, and it suggests a warped valence band.

Electroplated Metals on Uranium for Aluminum Cladding. John G. Beach, William C. Schickner, Dolores Hopkinson, and Charles L. Faust. U. S. Atomic Energy Commission, BMI-996, May 4, 1955, pp. 28. (OTS $0.50)

Aluminum-clad nickel-plated uranium is corrosion resistant in boiling water. Samples with intentional defects in the aluminum-nickel cladding layers, after testing for more than 300 hr, showed no sign of rapid failure. The study of electroplated metals on uranium for aluminum cladding defined the effects of several processing variables on the corrosion resistance. The quality of the uranium and the quality of the aluminum-nickel bond were important. Heat treatment and vacuum outgassing of the nickel-plated uranium prior to aluminum cladding were beneficial, and minimizing the amount of air present in the hot-pres assembly was desirable.

The Effect of Hydrogen on the Mechanical Properties of Titanium-Aluminum Alloys. L. W. Berger, D. N. Williams, and R. I. Jaffee. PB 129896; March 1, 1957, pp. 18. (LC mi $2.70, ph $4.80)

The effects of H on the properties of alloys containing 2.5, 5, and 7% Al were studied. Increasing the Al content increases the apparent solubility of H. Notch-bend impact strength, however, was seriously lowered by adding 80 ppm H, and addition which was sufficient to show hydride in the structure. In the Ti-5Al and Ti-7Al alloys hydride did not appear in the microstructure until 315 and 415 ppm, respectively, were added. This increased solubility of H resulted in considerable strengthening withotu loss in ductility as well as increased tolerance to impact embrittlement.

Proceedings of the Propellant Thermodynamics and Handling Conference. Loren E. Bollinger and Alexis W. Lemmon, Jr., editors. Engineering Experiment Station, Ohio State University, Columbus, Ohio.

Papers pertain to: the computation of equilibrium exhaust-product composition and performance of liquid rocket propellant systems by machine digital computers; the basic physical and thermodynamic data of liquid propellants and their combustion products; and the thermodynamic analysis of processes in rocket engines. The propellant handling area had papers covering such aspects as materials problems, handling techniques, safety, and toxicity of high-energy and cryogenic liquid propellants and their combustion products were accepted as being in the propellant thermodynamics area. The 20 papers presented cover B, H, F, and 0 as used in rocketry. Safety is stressed.

Some Optical Properties of Cadmium Telluride. P. W. Davis and T. S. Shilliday. *Physical Review*, v. 118, no. 4, May 15, 1960, p. 1020-1022.

Samples having a carrier concentration of the order of 10^{15} cm^{-3} were measured. The index of refraction in the infrared was determined to be 2.61. Values of the absorption coefficient α as a function of frequency were obtained at various temperatures. It was found that at room temperature the minimum energy for direct transitions is 1.50 ev; that for indirect transitions is 1.44 ev.

The Welding of Titanium and Titanium Alloys. G. E. Faulkner and C. B. Voldrich. PB 151079, DMIC Report 122, December 31, 1959, 66 pp. (OTS $1.75)

Describes chemical and metallurgical characteristics of alloys, surface preparation, welding methods, quality control procedures, stress relieving techniques, and mechanical properties of welded joints.

Reactions of Unsaturated Fatty Alcohols. XII. Polymers From Polyunsaturated Fatty Vinyl Ethers and Certain Cross-Linking Monomers. L. E. Gast, R. J. Stenberg, Wilma J. Schneider, H. M. Tetter, H. O. Schoen, B. G. Brand, and E. R. Mueller. *Official Digest*, v. 32, pt. 1, August, 1960, p. 1091-1101.

Reports the preparation and film properties of copolymers and terpolymers of unsaturated fatty vinyl ethers and allyl vinyl ether, 2-vinyloxyethyl methacrylate, and 1,2-divinyloxyethane. When properly formulated these films showed excellent adhesion, flexibility, and acid and alkali resistance, but were somewhat lacking in hardness.

Design and Fabrication Properties of High-Strength Steels. A. M. Hall. *Machine Design*, v. 32, July 21, 1960, p. 174 + 4 pages.

Considers the following structural materials for the range 180,000 to 300,000 psi: low-alloy hardenable steels, chromium hot-work die steels, martensitic stainless steels, semi-austenitic stainless steels, and cold-rolled austenitic stainless steels. Mechanical properties, effect of alloying additions, workability, and applications are discussed.

Irradiation Effects on Massive Uranium Monocarbide. Alan W. Hare and Frank A. Rough. U. S. Atomic Energy Commission, BMI-1452, July 21, 1960, 28 pp. (OTS $0.75)

The results of examinations of UC compounds having nominal compositions of uranium-4.6, -4.8, and -5.0 w/O carbon are encouraging after irradiation to burnups of from 400 to 15,000 MWD/T of U. Density changes were small. Cracking occurred in all specimens; however, it can probably be attributed to thermal stresses and to oxidation, after decapsulation, of NaK entrapped in microcracks. Metallographic examination shows that the UC_2 phase disappears at high temperature and high burnup.

Some Notes on Safe Handling Practices for Beryllium. Webster Hodge. PB 161 153; DMIC Memo 2, September 22, 1958, 13 pp. (OTS $0.50)

Discusses maximum alowable atmospheric concentration, method of air sampling and analysis, and general hygenic programs at various laboratories and plants.

Surface Aging of Titanium Alloys. F. C. Holden and R. D. Buchheit. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, Apr. 1960, p. 383-384.

Certain α-titanium alloys are susceptible to the formation of titanium hydride at the surface of metallographic specimens. The hydrogen probably is diffused into the surface from a residual film of etchant decomposition products. Estimates of the H content of metallographic samples from the amount of visible TiH thus may be grossly in error unless the specimen is examined immediately after preparation.

An Automatic Recorder for a Calorimeter. (*In German.*) Automatisches Registriergerat fur ein Kalorimeter. G. Kastner. *Chemiker-Zeitung/Chemische Apparatur*, v. 84, no. 15, Aug. 5, 1960, p. 497-499.

With the help of an accessory instrument adapted to the commercial combustion calorimeter, easier calorimetric measurements and, especially, more systematic series measurements are possible. The test is automatically controlled by the instrument, which, in addition, gives an objective recording of the temperature change in the calorimeter, so that the readings obtained can be checked. The accuracy obtained with the recording attachment is as high at least as that resulting from the usual method for calorimetric measurements with the Beckmann thermometer.

The Fabrication of Subassemblies for the Supercritical-Water Reactor. J. R. Keeler and A. W. Hare. U. S. Atomic Energy Commission, BMI-919, Aug. 16, 1954, pp. 30. (Lc mi $2.70 ph $4.80)

The limited ductility of stainless steel-UO_2 fuel sheet made the fabrication of corrugated-flat-plate-type subassemblies impractical. A fabricable MTR-type assembly, ⅝ in. square and 30 in. long was developed. Methods for edge cladding fuel sheet were developed and a brazing alloy, GE-75, was found to be corrosion resistant in a super-critical water.

The Fabrication of Stainless Steel—Uranium Dioxide Fuel Elements. J. R. Keeler, D. L. Keller, and L. J. Cuddy. U. S. Atomic Energy Commission, BMI-904, Mar. 2, 1954, pp. 28. (LC mi $2.70 ph $4.80)

Stainless steel-clad fuel sheet 0.020 in. thick with a 0.008-in. core of stainless steel plus UO_2 was produced by roll cladding a powder-metal compact. The effects of processing variables, core-matrix composition, quantity of oxide, and oxide particle size on the properties of the sheet were investigated. The strength and ductility of the core decreased sharply as the quantity of oxide in the core increased from 20 to 40 w/o. Over the range of matrix compositions investigatde, the particle size of the oxide had little effect on the core strength.

The Effects Interstitial Elements on Welds in Alpha-Beta Titanium Alloys. W. J. Lewis, M. L. Kohn, and G. E. Faukner. PB 129 436; March 31, 1956, pp. 87. (LC mi $4.80, ph $13.80)

Welding studies were conducted to determine the effects of C, N, and O on the mechanical properties of inert-gas metal-arc-welded joints in selected experimental alpha-beta titanium alloys. In practically all cases, these elements had a deleterious effect on the ductility and toughness of welds. A study also was made to determine the effects of H on the mechanical properties of titanium-iron alloys. Deleterious effects were observed on the mchanical properties of the base metals and welds of the Ti-1.5Fe and Ti-3.0Fe alloys due to added H.

Measurement of the Parameters in the Thermoelectric Figure of Merit. E. H. Lougher. *Electrical Engineering*, v. 79, May 1960, pp. 358-364.

Some of the more effective methods for measuring such important parameters of thermoelectric materials as Seebeck coefficient, thermal conductivity, and electrical resistivity are described.

Future Application Trends for Titanium and Steel in Military Aircraft. W. Stuart Lyman and Fred L. Bagby. PB 161 167; *DMIC Memo 17*, May 8, 1959, pp. 6. (OTS $0.50)

Concludes that the usage (and the usefulness) of Ti in air weapons will increase continuously from 1961 to 1968. Titanium alloys will continue to be less available than alternative steels inthe 1960's. Fabrication of steel and titaniumalloys will be equally easy (or difficult), except that brazing of honeycomb sandwich will be a special problem for titanium alloys, and welding will be more difficult for Ti than for steel. Cost considerations will invariably favor steel.

The Availability and Properties of Rhenium. Daniel J. Maykuth. PB 161 169; *DMIC Memo 19*, May 22, 1959, pp. 11. (OTS $0.50)

Surveys occurrence of ores, production statistics, mechanical, physical, and fabrication properties, and present and future applications of unalloyed rheniu mand rhenium alloys.

Development of Corrosion-Resistant Niobium-Base Alloys. Daniel J. Maykuth, William D. Klopp, Robert I. Jaffee, Warren E. Berry, and Frederick W. Fink. U. S. Atomic Energy Commission, BMI-1437, May 12, 1960, pp. 89. (OTS - $2.00)

The hot-water corrosion resistance and mechanical properties of niobium and a number of its alloys were evaluated with a view toward determining their usefulness in pressurized-water thermal reactors. Unalloyed niobium is rapidly attacked by 600 and 680 F water and 750 F steam. However, a number of alloying additions were found which markedly improve the corrosion resistance of niobium. Of these, binary and ternary combinations of chromium, molybdenum, titanium, vanadium, and zirconium were among the most effective. Many of these alloys show as low or lower weight gains than those obtained for Zircaloy-2 under similar test conditions.

The Status of Chromium-Base Alloy Development. Daniel J. Maykuth. PB 161 157; *DMIC Memo 6*, January 30, 1959, pp. 8. (OTS $0.50)

Reviews available information on phase relationships, fabrication, mechanical properties, oxidation resistance, and future outlook.

The Zone-Purification Process as a Method of Preparation of Potable Water From Sea Water. S. E. Miller, R. C. Himes, and H. L. Goering. PB 161 392, *Saline Water Research and Development Progress Report*, No. 17, January, 1958, pp. 16. (OTS $0.50)

Temperature in the freezing compartment, rate of crystallization, solution concentration, and agitation were found to influence the efficiency of the proces. In an effort to clarify certain anomalies in the results of earlier studies, apparatus was devised in which visual observations could be made directly and continuously in the freezing system. Studies (microscopic and analytical) of the nature of ice laid down from salt solutions at various rates and concentrations and under varying degrees of agitation have shown that, while good clear ice may be crystallized at reasonably high rates (2 inches per hour) from dilute solutions, the rate at which such ice may be grown is suppressed as solution concentration is increased (other conditions being held constant). In directional freezing experiments on sea water, it was found possible to prepare excellent drinking water (less than 50 ppm total salt concentration) in a two-stage program.

Note on Measurement of Figure of Merit of Thermoelectric Materials. W. C. Myers and R. T. Bate. *Review of Scientific Instruments*, v. 31, April, 1960, pp. 464-466.

Describes method and apparatus for determining the figure of merit of thermoelectric materials at low temperatures. AC and DC measurements can be made with the same potentiometer and current supply with an over-all accuracy of ± 0.02% without altering the potentiometer internally.

Fabrication of 17-7PH and PH15-7Mo Stainless Steel by Bend Rolling, Deep Drawing, and Spinning. C. T. Olofson. PB 161 168; *DMIC Memo 18*, May 15, 1959, pp. 4. (OTS $0.50)

The procedures recommended for 301 stainless steel can be used as a guide when forming either 17-7PH or PH15-7Mo. Certain modifications, however, are outlined to compensate for the differences in properties.

Surface Culture in the Mass Growth of Bacteria. F. E. Porter and H. Nack. *Journal of Biochemical and Microbiological Technology and Engineering*, v. 2, no. 2, 1960, pp. 177-186.

Determines the feasibility of growing bacteria in quantity on solid media in closed vessels. Techniques investigated in the laboratory were: growth on agar, growth on paking in beds, growth on solids in a fluidized bed, growth in foamed medium, and growth on semipermeable membranes. Data obtained were used to scale up these techniques on paper and compare the projected plants with a conventional submerged fermentation production. All the techniques compared unfavorably with submerged culture on the basis of plant and operating costs, operating complexity, equipment complexity, and safety. One technique of surface culture, growth on semipermeable membranes, appears to offer a decided advantage over submerged culture, in that the cell can be recovered directly as a paste.

Analysis of Acrylonitrile Copolymers by Infra-Red Spectrophotometry. A. Piguet, J. Rosset, and Ch. Eyraud. (*In French.*) Analyse des copolymères d' acrylonitrile par spectrophométrie infra-rouge. *Société Chemique de France, Bulletin*, 1960, no. 5, May, pp. 901-906.

The differentiation of the copolymers of acrylonitrile-acrylic acid, of acrylonitrile-acrylate, or of methyl methacrylate by infrared spectrophotometry implies a knowledge of the mutual actions of the functional groups. The tinctorial properties of the functional groups. The tinctorial properties of polyacrylonitrile fibers can be improved considerably by distributing acid or ester functions in small proportions in the macromolecular chain, but characterization of the polymers obtained raises analytical difficulties that are hard to overcome.

Further Studies on Large-Batch Melting of Uranium. George W. Rengstroff and Harold W. Lownie, Jr. U. S. Atomic Energy Commission, BMI-1015, July 11, 1955, pp. 31. (OTS $0.50)

Investigations on the feasibility of melting uranium in open induction furnaces were conducted. One-ton heats were successfully poured iron ingot molds. Rammed linings of MgO plus Al_2O_3 and preformed crucibles of MgO were both used sucessfully for melting. It was established that heats of ten tons or more coudd probably be made in production furnaces without the use of a vacuum.

Apparatus for the Study of Fission-Gas Release From Neutron-Activated Fueled Graphite. Harvey S. Rosenberg, Robert Lieberman, Duane N. Sunderman, and Ward S. Diethorn. U. S. Atomic Energy Commission, BMI-1444, June 7, 1960, pp. 8. (OTS $0.50)

A simple laboratory apparatus for the study of fission-gas release from neutron-activated fueled graphite was developed. Xenon-133 released from a heated specimen is carried in a helium sweep gas to a charcoal trap, where the accumulated activity is monitored continuously by a scintillation detector, ratemeter, and pen recorder. The maximum specimen temperature (2500 F) is achieved in 10 min with an induction heater. All instrumentation is commercially available.

Uranium Monocarbide—Fuel of the Future? F. A. Rough and R. F. Dickerson. *Nucleonics*, v. 18, March, 1960, pp. 74-77.

UC is a strong contender as a reactor fuel because of higher burnup and operating temperature than metallic fuel and higher thermal conductivity and uranium density than UO_2. Problems are reactivity with water, pyrophoricity and thermal-stress cracking.

Ultrahigh Pressure Technology. C. M. Schwartz. *Chemical Engineering Progress*, v. 56, August, 1960, pp. 71-76.

Synthesis of new materials having unique properties and the opportunity to explore geochemical and geophysical processes are becoming feasible with the rapid laboratory development of high pressures and temperatures. Pressure, as another degree of freedom, may be capable of producing new phases that do not undergo phase transitions at high temperatures. Development of improved high pressure and temperature apparatus means that geochemical processes and chemical synthesis are now open to exploration.

Elevated-Temperature Mechanical Properties and Oxidation Resistance of Columbium and Its Alloys. F. R. Schwartzberg and W. D. Klopp. PB 161 159; *DMIC Memo 8*, February 4, 1959, pp. 10. (OTS $0.50)

The strength of unalloyed Cr decreases rather rapidly from approximately 70,000 psi at the ductile-brittle transition temperature (−150 to −250 F) to less than 40,000 psi at room temperature. Above room temperature, strength decreases more gradually with increasing temperature. Alloying with the solid-solution elements such as Ti, V, W, Mo, and Ta greatly increase the elevated-temperature tensile strength. Binary additions of Ti, Zr, Mo, V, Cr, and W improve the oxidation behavior of Cb at 1000 C and 1200 C by factors of about 10 and 6, respectively.

Extrusion Cladding of Fuel Elements. C. J. Slunder, R. J. Fiorentino, and A. M. Hall. U. S. Atomic Energy Commission, BMI-989, March 22, 1955, pp. 33. (OTS $0.50)

The feasibility of sheathing flat-plate uranium fuel elements (3 by 0.180-in. cross section) with aluminum by the extrusion-cladding process was investigated. Exploratory extrusion-cladding tests were made which indicated that a stationary hollow mandrel, concentric with a hollow billet and ram, is necessary to extrude seamless clads. In a large-scale extrusion assembly, designed t accommodate a 3 by 0.180-in. core, a 5/32-in.-thick clad was extruded. Plasticine experiments were made with models of the extrusion assemblies to study some of the variables affecting the extrusion-cladding process.

Magnetohydrodynamic Cavities. Bernard Steginsky. *American Rocket Society Journal*, v. 30, July 1960, pp. 642-643.

Some features of magnetohydrodynamic cavity formation are discussed in qualitative terms. Examination of the dependence of the final steady-state configuration on the initial conditions in two cases reveals incompatibilities which may arise in the physical interpretation of the problem if a proper "model" is not specified.

Automation and New Processes in Making Iron and Steel. John D. Sullivan. *Skillings' Mining Review*, v. 49, no. 9, May 28, 1960, pp. 1-6; no. 10, June 4, 1960, pp. 1 + 4 pages.

Only outstanding highlights are discussed and statistics, unless otherwise stated, apply to the United States. Tonnages are given in net tons. Automation and new processes and innovations are so inter-related that no rigorous attempt is made to keep the the discussion of the subjects separate. A table is given for background information to show the present state of the art of the type of furnaces used in steelmaking. Automation, pig iron production, conventional steelmaking, and new processes are reviewed in turn.

Enamels and Enameling Techniques for Coating Uranium Slugs. Harlan P. Tripp, John Schultz, Burnham W. King, and Winston H. Duckworth. U. S. Atomic Energy Commission, BMI-1024, August 2, 1955, pp. 18. ($0.50)

Porcelain-enamel coatings and application techniques were developed for the enameling of uranium slugs used in Hanford reactors. These coatings were developed for appraisal as thermal or diffusion barriers between the slug and its aluminum can. Variables in metal treatment, enamel composition, and firing conditions were investigated. The basic requirements for satisfactory enamels of adherence, uniform thickness and a smooth surface, and low thermal-neutron-absorption cross section were achieved.

Survey of Materials for Supercritical-Water Reactor. Murray C. Udy and Francis W. Boulger. U. S. Atomic Energy Commission, BMI-890, November 27, 1953, pp. 52. (LC mi $3.30 ph $7.80)

Tensile strength, 0.2% offset yield strength, 1000 hr rupture strength, endurance strength, tensile elongation, Young's modulus, coefficient of thermal expansion, coeffiicent of thermal conductivity, usual heat treatment, density, and thermal-neutron-absorption cross sections are tabulated for SAE 4340; Timken 17-22-A, 17-22-A S, and 17-22-A V; Types 310, 347, 410, and Crucible 422 stainless steels; Jessop H46; R.ex 448; Armco 17-4 PH, and 17-7 PH; Stainless W; Allegheny A-286; Tinidur; Discaloy; Nimonic 75, 80, and 80A; Hastelloys C and X; Inconel X; Copper Alloy V2B; and titanium alloys RC 130 B, RC A110AT, Ti155AX, and Ti-3 Mn complex.

Strength, Stability, and the Equicohesive Point. E. E. Underwood. *Institute of Metals, Journal*, v. 88, 1960, pp. 266-271.

A series of high-purity alloys based on iron-18% Cr, balance Ni, was prepared to include the α, $(\alpha+\gamma)$, and γ phase fields. Strengths were measured by means of creep, tensile, and hardness tests. Stability was evaluated from the rate of decrease of high-temperature strength with time. It is shown that the ambiguity connected with the equicohesive temperature can be eliminated when time or strain-rate effects are accounted for, thus conferring a unique value on the transition between low and high-temperature behavior. This fixed value is called the equicohesive point, rather than the equicohesive temperature.

Formation of Dispersions in Molten Copper by Mechanical Mixing. D. N. Williams, J. W. Roberts, and R. I. Jaffee. *Modern Castings*, v. 37, March, 1960, pp. 81-85.

The feasibility of forming dispersion hardened copper-base alloys by adding the dispersion phase to molten Cu just before casting was studied. The importance of wettability in the successful application of this process is discussed, and results from a simple laboratory wettability test procedure are presented. Based on these results, molybdenum and tungsten carbide were selected as suitable dispersion materials in copper alloys prepared in this manner. Molybdenum was successfully dispersed in a copper-aluminum alloy, but tungsten carbide could not be maintained in molten Cu, apparently as a result of a strong tendency agglomeration.

The Properties of Boron. D. N. Williams. PB 161 191, *DMIC Memo 41*, January 4, 1960, pp. 9. (OTS $0.50)

The element boron has properties that have given rise to speculation on its possible use as a structural material. However, considerable careful work in reduction and purification of boron has produced nothing encouraging. The purest material available today shatters at low impact, has no ductility, and such poor thermal-shock resistance that it breaks up on cooling slowly from the temperature at which it was produced to room temperature. This memorandum is written to collect as much authentic information as is available and to disseminate this to researchers who may be interested in the future potential and present limitations of boron.

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ABSTRACTS

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

10990 Vitamins—Perspectives and Prospectives. Can man, can the scientist, hasten the process of discovery and the integration of separated discoveries, or must nature take its own course? Dr. Karl Folkers, 1960 Perkin Medal recipient, cites the knowledge that the rate of discovery increases under the effect of war, or some other crisis, as evidence that there are ways of accelerating research discovery. Under conditions of crisis, Dr. Folkers claims, "The scientist will direct his mind and energy to significant and specific objectives. His willingness to do so is just as potentially available in peacetime". In addition to planned research—basic research directed at a specific target—he discusses four other means of speeding up useful discoveries, drawing mostly upon the history of nutrition research for examples. "Spurts of progress can be achieved frequently by the use of new and powerful methodology", he claims, and cites advances due to the use of chromotography, X-ray crystallography, proton nuclear magnetic resonance techniques, and mass spectrometry to make his point. He criticizes the use of experimental models which are not valid for the problem being studied. Specifically, he suggests that the continued use of mice and rats in human nutrition research, rather than the more comparable primate species, was "penny-wise and pound-foolish". He urges the scientist to depend less on empiricism and more on theoretical insight for speeding progress. Comparing complex biosynthetic processes which take place in minutes to the laboratory syntheses of far simpler materials which may require months, he says, "More and more knowledge about the mechanism of biosynthesis will give us the theoretical insight to speed-up achievement". Finally, he recommends research by a requisite group representing all essential disciplines as a means of integrating discoveries in different areas of science. ***Karl Folkers.*** *Chemistry & Industry,* 1960, no. 30, July 23, 1960, p. 946-951.

10991 Engineering Administration. One way to get rid of the nontechnical chores and details that hamper the basic engineering job is to trim them out of engineering and organize them into a separate function. ***Robert G. Murdick.*** *Machine Design,* v. 32, July 7, 1960, p. 100-106.

10992 Climate for Creativity. Seventeen ways engineering management can build and improve it. Gives do's and don'ts by which management can generate and maintain a climate in which creativity fluorishes. ***Eugene Raudsepp.*** *Machine Design,* v. 32, July 21, 1960, p. 122-130.

10993* Does Research Depend on Big Business? A study of important inventions discloses that about 40% of them were the product of independent inventors. ***D. Hamberg.*** *Management Review,* v. 49, July 1960, p. 32-34.

10994* Memoirs of an Industrial Chemist. III. Recruiting Research Talent. The desired qualities of a research worker and methods of selection are discussed. ***M. L. Burstall.*** *Manufacturing Chemist,* v. 31, June 1960, p. 250 + 4 pages.

10995* Basic Research: An Industrial Responsibility. Recommends that industrial plants support scientific education and research and regard it as an essential part of their own business. In this way it is possible to have a steady influx of first-rate young scientists. ***George B. Kistiakowsky.*** *Research Management,* v. 3, no. 2, Summer 1960, p. 69-76.

10996* Middle Management of Research and Development. Like any activity requiring skill, management must be learned by doing, but will be learned better if practice is accompanied by reflection, self-criticism, and vicarious learning. As an activity that works upon reality through other people, it is not complete in itself. The manager is dependent for his ultimate accomplishment upon the quality and effectiveness of his staff. ***M. T. O'Shaughnessy.*** *Research Management,* v. 3, no. 2, Summer 1960, p. 85-92.

10997* The Research Management Study Group Program of the Industrial Research Institute. The study group program as developed by the Industrial Research Institute is an

* Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

excellent means of distilling the modern practices of research management into useful reports suitable for dissemination. The study groups have not been formal teaching workshops, but all participants have learned a great deal in the course of the discussions. ***Thomas H. Vaughn.*** *Research Management*, v. 3, no. 2, Summer 1960, p. 93-96.

10998* Proceedings of Industrial Research Institute Study Group Meetings. I. The Environment for Creativity. The agenda of the meeting was as follows: discussion and definition of terms with the intent to establish sufficient agreement on language to avoid confusion in subsequent discussions; brief examples of deliberate actions aimed at the establishment of more creative environments; a working session devoted to the discussion of psychological, organizational, and fiscal factors which appear to influence a creative environment. ***James A. Bralley.*** *Research Management*, v. 3, no. 2, Summer 1960, p. 97-122.

See also: **11476** (bibliography on implications of scientific research).

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

10999 Advances in Applied Mechanics. Theory of unsteady laminar boundary layers; boundary-layer theory with dissociation and ionization; propagation of shock waves along ducts of varying cross sections; similarity and equivalence in compressible flow; Kármán vortex streets. ***H. L. Dryden and Th. von Kármán, editors.*** v. VI. 294 pp. 1960. Academic Press, New York. (TA350 Ad95 Vis.)

11000 Support Systems. I. Scope and Techniques. Provides definitions, describes typical provisioning procedures, and emphasizes the requirement that an ICBM support system be consistent with an over-all logistics plan derived after a comprehensive operational analysis. A support system designed at this time should be more concerned with man-machine relations. ***Beal M. Teague.*** *Aero/Space Engineering*, v. 19, July 1960, p. 16-19.

11001 Sonic Boom—Limitations on Supersonic Aircraft Operations. An attempt is made to find the most favorable speed-altitude schedule for a supersonic transport or bomber, with minimum shock-wave noise as the prime consideration. The propagation of shock waves is discussed for the case of a homogeneous atmosphere. ***Donald W. Patterson.*** *Aero/Space Engineering*, v. 19, July 1960, p. 20 + 6 pages.

11002 Prediction of Flexibility and Natural Modes of Low Aspect Ratio Wings Using Stiffness Matrices. Stiffness matrices previously developed are used in the analysis of complex wing structures. Favorable statistical comparisons of measured and analytical influence coefficients are presented for a swept wing involving intermediate stiffeners and multispar design. ***Robert J. Melosh and Richard G. Merritt.*** *Aero/Space Engineering*, v. 19, July 1960, p. 25 + 7 pages.

11003 Heat Protection by Ablation. The recent extensive use of ablation materials has raised basic questions concerning what properties to look for in ablation systems for accomplishing different tasks. Some practical answers are provided for different popular materials and applications. ***Robert M. Wood and Ronald J. Tagliani.*** *Aero/Space Engineering*, v. 19, July 1960, p. 32 + 7 pages.

11004 The Use of Ramjet and of Rocket in Long Range Flights. The suitability of ballistic or aerodynamic lift in long-range distances is studied on the basis of the aerodynamic efficiency and the use of ramjets, especially of steady-stable-detonation-combustion ramjets, preferably to ballistic rockets is examined. (*In Italian.*) Impiego dello statoreattore e dell'endoreattore nelle grandi percorrenze. ***Licio Giorgieri.*** *Aerotechnica*, v. 45, no. 1, Feb. 1960, p. 34-38.

11005* The Avoidance of Ground Resonance. An examination is made of the way in which the ground resonance properties of a helicopter depend on the fuselage damping, blade damping, drag hinge offset, inter-blade spring stiffness, blade mass and angular velocity of the rotor. ***H. L. Price.*** *Aircraft Engineering*, v. 32, June 1960, p. 156-160.

11006* The Use of Teflon as an Ablation Material. Advantages of cooling by ablation; the chemistry of teflon decomposition including formulas for the speed of decomposition and the heat of depolymerization; application to the thermal protection of a missile; mechanism of the cooling effect; effect of the exponential character of the speed of decomposition of teflon as a function of temperature; mass transfer; effect of gas injection into the limit layer. (*In French.*) L'utilisation du téflon comme matériau d'ablation. ***J. Cornillon.*** *Docaéro*, no. 62, May 1960, p. 33-38.

11007 Compressibility Effects in Magnetoaerodynamic Flows Past Thin Bodies. The effects of compressibility on the steady motion of a highly conducting fluid past thin cylindrical bodies in the presence of a magnetic field are studied. Procedures are developed for the solution of this class of magnetoaerodynamic problems over the entire Mach number range and for all ratios of magnetic to fluid-dynamic pressure. ***J. E. McCune and E. L. Resler, Jr.*** *Journal of the Aero/Space Sciences*, v. 27, July 1960, p. 493-503.

11008 On Supersonic Flow Past Thick Airfoils. The inviscid rotational supersonic flow behind the shock wave attached to the sharp leading edge of an airfoil is studied by a transformation of coordinates which introduces the Crocco stream function Ψ as an independent variable. Using expansions in the power series of Ψ, an iterative process is developed for the determination of pressure distribution along the airfoil surface. ***Abraham Kogan.*** *Journal of the Aero/Space Sciences*, v. 27, July 1960, p. 504 + 5 pages.

11009 Improvement of the Approach and Landing Characteristics of Modern Fighters. In order to have available a large number of airfields, which could be dispersed to improve the efficiency of the aircraft and facilitate their protection against sabotage or attack, cement runways should be replaced by short grass runways (about 3,500 ft or less). Discusses the reasons for a deterioration in the low-speed performance and flying characteristics of high-speed aircraft and indicates some ways in which this can be remedied. ***J. Czinczenheim and P. Jaillard.*** *North Atlantic Treaty Organization, AGARD Report No.* 225T, Oct. 1958, 24 pp. (TL565 Ag11r Vis.)

11010 Principles of Guided Missile Design. Systems Preliminary Design. General design considerations, missile-system reliability, guidance and control design data, command guidance kinematics, kinematics of beam-riding missiles, heat transfer-performance, stability and control, structures, and preliminary-design procedure for missile systems are discussed. ***Grayson Merrill, editor.*** 625 pp. 1960. D. Van Nostrand Co., Inc., Princeton, N. J. (UG630 M55p)

11011 Proceedings of the Manned Space Stations Symposium. Manned space flight, the military test space station, atmospheric entry of manned vehicles, design criteria, a modular concept for a multi-manned space station, manned scientific orbital laboratory, gravity problems in manned space stations, analysis of space radiation phenomena, satellite astronomical observatories, explosive failure in pressurized space cabins, and other problems are discussed. 322 pp. 1960. Institute of the Aeronautical Sciences, New York. (TL797 M31p)

11012* On Rayleigh's Problem for Compressible Fluids. A study is made of the unsteady flow generated in a viscous heat-conducting gas by an infinite flat plate set suddenly in motion in its own plane. The corresponding Navier-Stokes equations, linearized for small Mach number, are treated by operational methods and yield a large-time representation of the flow, a short-time representation, and a method for numerical evaluation of the flow at arbitrary time. ***Meir Hanin.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 13, pt. 2, May 1960, p. 184-198.

11013* The Steady Incompressible Boundary-Layer Flow Past a Flat Plate With a Parabolic Leading Edge. It is shown that the full equations of motion for the steady flow of an incompressible liquid have a simple approximate solution, valid in a boundary layer near the plate, when the velocity at infinite distance from the plate is of constant magnitude and

parallel to the x-axis. ***J. Wilkinson.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 13, pt. 2, May 1960, p. 199-209.

11014* Heat Transfer by Laminar Flow From a Rotating Spherical Cap at Large Prandtl Numbers. An approximate method, described recently by Davies, for calculating heat transfer from a rotating disk is extended to the problem of calculating the distribution of rate of heat transfer by laminar flow from a heated, rotating, spherical cap for an arbitrary, meridional distribution of surface temperature and for large Prandtl numbers. ***C. B. Baxter and D. R. Davies.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 13, pt. 2, May 1960, p. 247-250.

11015 Determination of Factors Governing Selection and Application of Materials for Ablation Cooling of Hypervelocity Vehicles. Presents results obtained from tests of samples of 52 different materials. The samples were exposed to the high-temperature plasma discharge produced in an air-stabilized electric arc. Reports sample shape, test conditions and test procedure, and the material behavior. ***John H. Bonin, Channon F. Price, and Henry Halle.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-87, Feb. 1960, 151 pp. (TL507 Un3.18w Vis.)

11016 Tests of an Area Suction Flap on an NACA 64A010 Airfoil at High Subsonic Speeds. Lift and drag of an airfoil with a 30%-chord plain flap were measured, both with and without suction. The chordwise extent of perforated suction area downstream of the flap hinge line was varied. Data were obtained at a Reynolds number of 2.9×10^6 for a range of Mach numbers from 0.70 to 0.84 with several different suction-area configurations. ***Donald W. Smith and John H. Walker.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-310, May 1960, 43 pp. (TL570 Un3t Room 290)

11017 Investigation of the Aerodynamic Characteristics of a Combination Jet-Flap and Deflected-Slipstream Configuration at Zero and Low Forward Speeds. The aerodynamic characteristics of a semispan wing equipped with a 38.5%-chord sliding flap partially immersed in the slip-stream of two propellers were studied. A jet of air was ejected over the knee of the flap through a momentum range from zero to about 1.0. This investigation was made to provide data on the combined effects of a jet-flap and a flap-deflected slipstream at zero and low forward speeds. Pressure distributions near the wing leading edge behind the inboard propeller for conditions out of ground proximity and within ground proximity were obtained. ***Kenneth P. Spreeman and Edwin E. Davenport.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-363, May 1960, 72 pp. (TL570 Un3t Room 290)

11018 An Investigation of Induced-Pressure Phenomena on Axially Symmetric, Flow-Alined, Cylindrical Models Equipped With Different Nose Shapes at Free-Stream Mach Numbers From 15.6 to 21 in Helium. Induced-pressure-distribution studies were made and schlieren photographs were taken. The nose shapes were a hemisphere, a 45° included-angle cone, a 90° included-angle cone, a hemispherically blunted 45° included-angle cone, a hemisphere modified by a 90° included-angle conical tip, and a flat configuration. Static-pressure orifices were located along the cylindrical surface of the models from zero body diameters to 50 body diameters downstream of the nose-cylinder juncture. ***James N. Mueller, William H. Close, and Arthur Henderson, Jr.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-373, May 1960, 48 pp. (TL570 Un3t Room 290)

11019 Wind-Tunnel Investigation of a Small-Scale Model of an Aerial Vehicle Supported by Ducted Fans. The longitudinal-stability and pitching-moment characteristics and the power requirements of a simplified model of an aerial vehicle supported by ducted fans were investigated. The model had two ducted fans, both fixed with respect to the airframe with their axes of revolution vertical for hovering flight. Tests on the basic model in the tandem and side-by-side configurations indicated that the pitching moment and tilt angle required for trim at forward speeds were undesirably large. Turning vanes placed in the slipstream of the forward duct of the tandem configuration reduced both the pitching moment and tilt angle, but probably increased the power required. ***Lysle P. Parlett.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-377, May 1960, 24 pp. (TL570 Un3t Room 290)

11020* Stability of the Flow in a Cylindrical Annulus. Investigation of the helical flow in an annulus between two coaxial cylinders as regards its stability against the formation of helical vortices. Assuming the annulus to be small and the velocities to vary linearly with the radius, it is shown that the problem can be reduced to the classical case of flow between two rotating cylinders. Derives an appropriate stability criterion for helical flows. (*In German.*) Stabilitat der Stromung in einem zylindrischen Ringraum. ***Hubert Ludwieg.*** *Zeitschrift für Flugwissenschaften*, v. 8, May 1960, p. 135-140.

AGRICULTURE

11021 Insect Attractants Are Taking Hold. Lures offer a simple means of detecting insects. They can increase the efficiency of insecticide applications because treatments need be applied only where insects are caught and only as long as they are caught. ***Morton Beroza.*** *Agricultural Chemicals*, v. 15, July 1960, p. 37 + 6 pages.

11022* Symposium on the Mechanism of Action of Pesticide Chemicals. Four papers presented by the Division of Agricultural and Food Chemistry at the 137th meeting of the ACS in Cleveland, Apr. 1960. *Journal of Agricultural and Food Chemistry*, v. 8, July-Aug. 1960, p. 252-272.

11023* Use of Insects for Their Own Destruction. Four ways of using an insect species to destroy its own kind are: (1) the release of insects made sexually sterile by gamma radiation; (2) the use of chemicals that produce sexual sterility in the natural population of insects; (3) the release of adults infected with pathogens that would destroy larval progeny by transmitting the disease to other adults and contaminating the environment where the insect reproduces and develops; (4) the development and release of insect strains that carry deficient genetic characteristics. Such genetic deficiencies should be of a type that would not prevent rearing of the insect under controlled conditions or seriously interfere with the ability of the released males to compete with normal males in mating. Such genetic lethal factors would have to be expressed in the immature progeny or become lethal in the adult during hibernation. ***E. F. Knipling.*** *Journal of Economic Entomology*, v. 53, no. 3, June 1960, p. 415-420.

11024 Hybrid Corn and the Economics of Innovation. Geographic differences in the use of hybrid corn are explained by differences in the profitability of that use. ***Zvi Griliches.*** *Science*, v. 132, July 29, 1960, p. 275-280.

11025 Forage Juice in Swine Feeds. ***D. I. Gard.*** *U. S. Agricultural Research Service, ARS*-74-15, July 1960, unpaged. (S584 Un3.1ar Contin.)

See also: **11371** (cereals as feed); **11377** (growth factors in forage juices).

BIOCHEMISTRY AND BIOPHYSICS

11026* Basic Research Problems in Space Medicine: A Review. ***Robert T. Clark, et al.*** *Aerospace Medicine*, v. 31, July 1960, p. 553-577.

11027* Protein Synthesis From Amino Acids Associated With Ribonucleic Acid. The polynucleotide (sRNA) which reacts with amino acids in the presence of amino acid-activating enzymes and adenosine triphosphate has been purified. Maximal transfer of amino acids from this purified sRNA to the protein of isolated ribonucleoprotein particles requires rather sharply defined optimal conditions. Under such conditions, however, the amino acids bound to sRNA are converted into "soluble" protein more efficiently than are free amino acids. ***George C. Webster.*** *Archives of Biochemistry and Biophysics*, v. 89, no. 1, July 1960, p. 53-58.

11028* The Origin of Bacterial Species. Genetic Recombination and Factors Limiting It Between Bacterial Populations. ***Arnold W. Ravin.*** *Bacteriological Reviews*, v. 24, no. 2, June 1960, p. 201-220.

11029* The Tryptophan Synthetase System. ***Charles Yanofsky.*** *Bacteriological Reviews,* v. 24, no. 2, June 1960, p. 221-245.

11030 The Biochemistry of Development. Gametogenesis, fertilization, cleavage, chemical embryology of invertebrate eggs, chemical embryology of vertebrate eggs, biochemical interactions between the nucleus and the cytoplasm during morphogenesis, the biochemistry of differentiation are discussed. ***Jean Brachet.*** v. II. 320 pp. 1960. Pergamon Press, New York. (QL955 B72b)

11031* Effect of Homologous Bone Marrow—Spleen Cell Suspension on Survival of Swine Exposed to Radiation From a Nuclear Weapon. This therapy did not affect survival of animals receiving sublethal, intermediate, or supralethal doses of irradiation. No evidence of accelerated repopulation of hematopoietic or lymphatic tissues was found in the treated animals that died, compared with untreated animals dying at the same time. ***Harry W. Daniell and William H. Crosby.*** *Blood,* v. 15, June 1960, p. 856-862.

11032* Antagonism Between the Action of Staphylococcal Toxin and the Venom of Certain Snakes and Insects in Mice. The venom protects whether given subcutaneously to mice with the toxin or separately. This venom preparation and others also containing phosphatidase A given intravenously protect mice against the lethal effect of toxin by the same route. Venom preparations with little phosphatidase A activity have failed to protect. ***E. A. North and Hazel M. Doery.*** *British Journal of Experimental Pathology,* v. 41, no. 3, June 1960, p. 234-242.

11033* Factors Involved in the Action of Venoms Against Bacterial Toxins in Experimental Animals. Protection is proportional to concentration of phosphatidase A. The products of the action of this enzyme on phosphatides, namely lysophosphatides and long chain fatty acids, were examined. Two lysolecithins tested protected mice either when injected together with, or prior to, the challenge dose of toxin. Of the fatty acids studied, only unsaturated ones inactivated staphylococcal toxin. ***Hazel M. Doery and E. A. North.*** *British Journal of Experimental Pathology,* v. 41, no. 3, June 1960, p. 243-250.

11034* Growth and Toxin Production of Staphylococci in Cellophane Sacs *In Vivo*. The experiments recorded in this paper show that strains of coagulase positive staphylococci grow well *in vivo* when protected from phagocytes and antibacterial factors greater than *c* MW 20,000 by being enclosed in cellophane sacs. ***G. P. Gladstone and E. J. G. Glencross.*** *British Journal of Experimental Pathology,* v. 41, no. 3, June 1960, p. 313-333.

11035* The Possible Role of Viruses in Cancer. Symposium, sponsored by the American Cancer Society, held at Rye, N. Y., November, 1959. *Cancer Research,* v. 20, no. 5, pt. 1, June 1960, p. 669-830.

11036* A Factor Inhibiting the Intracellular Multiplication of the Viruses Resembling Interferon, Found in Cancerous Cells. The role of this inhibitor in the chronic infection of the KB cells by Myxovirus parainfluenzae III and during the process of self-inhibition is discussed. (*In French.*) Un facteur inhibiteur de la multiplication intracellulaire des virus rappelant l'interféron, provenant de cellules cancéreuses. Le phénomène d'autoinhibition virale. ***Charles Chany.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 250, no. 23, June 8, 1960, p. 3903-3905.

11037* The Virulence of Phytopathogenic Bacteria for Warm-Blooded Vertebrates. True pathogenic bacteria isolated from diseases in plants can be virulent for certain warm-blooded animals. *Microtus* seems to be especially receptive, since it can die a few hours after intraperitoneal inoculation of phytopathogenic microbes. (*In French.*) Virulence de bactéries phytopathogènes pour des vertébrés à sang chaud. ***Jean Brisou.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 250, no. 25, June 20, 1960, p. 4230-4231.

11038* Parallelism Between the Inhibition of the Cancerogenesis by Metals and the Release of the Involved Histamine. (*In French.*) Parallélisme entre l'inhibition de la cancérogenèse de métaux et la libération de l'histamine engagée. ***Simone Hatem.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 250, no. 25, June 20, 1960, p. 4232-4234.

11039 Design for a Brain. The Origin of Adaptive Behaviour. ***W. Ross Ashby.*** 2nd Ed. 286 pp. 1960. John Wiley, New York. (QP376 As34d2)

11040 Fungal Diseases of Animals. Aspergillosis, moniliasis, crystococcosis, epizootic lymphangitis, sporotrichosis, histoplasmosis, North American blastomycosis, coccidioidomycosis, haplomycosis, rhinosporidiosis, and other diseases are discussed. ***G. C. Ainsworth and P. K. C. Austwick.*** 148 pp. 1959. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England. (QR145 Ai66f)

11041* Multiplication of Tobacco Mosaic Virus in a Normally Insusceptible Host. Results demonstrate that the host range specificity of tobacco mosaic virus RNA is greater than that of the parent virus. As in the case of the protein of polio virus, the protein of tobacco mosaic virus plays an important role in the delineation of the host range of the intact virus. ***Milton Paul Gordon and Conley Smith.*** *Journal of Biological Chemistry,* v. 235, no. 6, June 1960, p. PC28.

11042* Nucleic Acids and Induced Amphibian Metamorphosis. ***F. J. Finamore and E. Frieden.*** *Journal of Biological Chemistry,* v. 235, no. 6, June 1960, p. 1751-1755.

11043* Allotypy of Rabbit Serum Proteins. I. Immunochemical Analysis Leading to the Individualization of Seven Main Allotypes. II. Relationships Between Various Allotypes: Their Common Antigenic Specificity, Their Distribution in a Sample Population; Genetic Implications. ***Jacques Oudin.*** *Journal of Experimental Medicine,* v. 112, July 1960, p. 107-142.

11044* Studies on Tolerance of the Y Chromosome Antigen in Mice. ***R. E. Billingham and Willys K. Silvers.*** *Journal of Immunology,* v. 85, no. 1, July 1960, p. 14-26.

11045* Calculation of the Rate of Uncoiling of the DNA Molecule. Assumes that the rate-controlling process is the unwinding of the ends driven by the increase of entropy on unwinding and hindered by the viscous resistance of the surrounding medium. It is calculated that the time needed for the two strands of a long DNA molecule to dissociate is of the order of a few seconds, the time increasing with the 5/2 power of the molecular weight. ***H. C. Longuet-Higgins and Bruno H. Zimm.*** *Journal of Molecular Biology,* v. 2, no. 1, Apr. 1960, p. 1-4.

11046* Electron Microscope Observations on the Structure of Microsomal Particles From *Escherichia coli*. Microsomal particles characterized by sedimentation coefficients of 100 s, 70 s, 50 s and 30 s have been investigated. The 100 s particles consisted of two 70 s particles joined together as a dimer. The 70 s particles could be seen to contain two subunits of unequal size with a well-marked cleft between them. The 50 s and 30 s particles were found to resemble closely the larger and the smaller subunits of the 70 s particles. The particles were not found to have a regular polyhedral form, in contrast to some small spherical viruses. The 50 s particles appeared to be very approximately dome-shaped. The 30 s particles had a flatter form with a rather irregular outline. ***H. E. Huxley and G. Zubay.*** *Journal of Molecular Biology,* v. 2, no. 1, Apr. 1960, p. 10-18 + 8 plates.

11047* The Molecular Configuration of Deoxyribonucleic Acid. I. X-Ray Diffraction Study of a Crystalline Form of the Lithium Salt. II. Molecular Models and Their Fourier Transforms. The DNA molecule is helical with pitch 34 Å, probably contains two polynucleotide chains, and each chain contains 10 nucleotides per turn. This configuration is known as the *B* type and exists in unfixed cell nuclei. The crystal lattice of LiDNA is orthorhombic and each unit cell contains one repeat unit of two DNA molecules. ***H. R. Wilson, C. W. Hooper, M. H. F. Wilkins, L. D. Hamilton, and R. Langridge.*** *Journal of Molecular Biology,* v. 2, no. 1, Apr. 1960, p. 19 + 41 pages + 5 plates.

11048* A Helical Structure in Mumps, Newcastle Disease and Sendai Viruses. ***R. W. Horne and A. P. Waterson.*** *Journal of Molecular Biology,* v. 2, no. 1, Apr. 1960, p. 75-77 + 6 plates.

11049* Effect of Dilantin Sodium on Growth of Human Fibroblast-Like Cell Cultures. Addition to tissue culture resulted in stimulation of cell proliferation. A similar but more limited stimulation to proliferation occurred with HeLa cells, but there was no detectable effect on cells isolated from rat fibrosarcoma. ***William G. Shafer.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 104, no. 2, June 1960, p. 198-201.

11050* Tremorine-Induced Rage and Its Antagonism by Atropine. ***W. W. Baker, M. J. Hosko, W. J. Rutt, and J. R. McGrath.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 104, no. 2, June 1960, p. 214-217.

11051* Lung Tumors in Hamsters Produced by Polyoma Virus. ***Theodore Burnstein.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 104, no. 2, June 1960, p. 220-223.

11052* Serumless Medium for Cultivation of Cells of Normal and Malignant Origin. A serumless medium suitable for prolonged growth and repeated subculture of Walker carcinosarcoma 256, sarcoma 180, KB and human heart cells *in vitro* is described. In addition to amino acids, vitamins, minerals and glucose, it contained insulin, salmine sulfate, pyruvate, mucate, methyl oleate, folinic acid and lactalysate. ***Robert E. Neuman and Alfred A. Tytell.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 104, no. 2, June 1960, p. 252-256.

11053* Essential Duration of Parabiosis and Development of Tolerance to Skin Homografts in Mice. ***Carlos Martinez, Fred Shapiro, and Robert A. Good.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 104, no. 2, June 1960, p. 256-259.

11054* Effect of Vehicle Components on the Absorption Characteristics of Sun Screen Compounds. The sun screen effectiveness is influenced by the addition of different components of a vehicle. The effects of the different additives are unpredictable and must be evaluated by spectrophotometric methods. Isopropyl palmitate is suggested as a tentative solvent standard upon which to base a modified sun screen index. ***Sidney Riegelman and Richard P. Penna.*** *Society of Cosmetic Chemists, Journal,* v. 11, no. 5, June 1960, p. 280-291.

11055 Synthesis and Organisation in the Bacterial Cell. ***E. F. Gale.*** 110 pp. 1959. John Wiley, New York. (QR84 G13s)

11056 Effects of Environmental Complexity and Training on Brain Chemistry. Investigates the possibility that the enzyme cholinesterase (ChE) is a dependent variable in the brain and may be influenced by environmental factors. A group of rats, designated as ECT (experiment complexity and training), was kept in a complex environment and trained in standardized test situations. Isolated control animals (IC) were kept in solitary confinement. The ECT group was lower than the IC group in cortical ChE activity. The ECT group was higher than the IC group in subcortical ChE activity. ***Edward L. Bennett, Hiromi Morimoto, Marie Hebert, and Ann Ohlander.*** *U. S. Atomic Energy Commission, UCRL-9135,* Mar. 18, 1960, p. 39-48. (UF767 U3u Contin.)

11057* On the Mechanism of the Recombinational Event in the Formation of Transducing Phages. ***Allan Campbell.*** *Virology,* v. 11, no. 2, June 1960, p. 339-348.

11058* The Fine Structure of Polyoma Virus. Spherical particles identified as viruses were found to have a mean diameter of 453 A. All the particles showed a shell (capsid) of elongated hollow subunits (capsomeres). In the majority, these surrounded a central core. It has been deduced that the particle contains 42 capsomeres, each aligned radially along an axis of symmetry. ***P. Wildy, M. G. P. Stoker, I. A. Macpherson, and R. W. Horne.*** *Virology,* v. 11, no. 2, June 1960, p. 444-457.

11059* Tryptic Peptides Within the Polypeptide Chain of Tobacco Virus and a New Manner of Determining Their Arrangement. ***H. G. Wittman.*** *Virology,* v. 11, no. 2, June 1960, p. 505-508.

11060 The Viruses. v. I. General Virology. v. II. Plant and Bacterial Viruses. v. III. Animal Viruses. ***F. M. Burnet and W. M. Stanley, editors.*** v. I. 609 pp; v. II. 408 pp; v. III. 428 pp. 1959. Academic Press, New York. (QR360 B93t)

CERAMICS AND CONCRETE

11061 Al_2O_3-Clad UO_2 Ceramics for Nuclear-Fuel Applications. A ceramic nuclear fuel consisting of a UO_2 core clad with dense Al_2O_3 was prepared in the laboratory. Processing involved the use of a special sinterable powder form of high-purity Al_2O_3. This powder was applied to unsintered UO_2 pellets by a spraying-tumbling technique followed by isostatic pressing, and then sintering in H. There was no measurable release of fission products from irradiated clad particles heat treated at 1700 F in vacuum for seven days after exposure to 6.0×10^{12} nv for one hr at room temperature. Sound claddings of other oxides, e.g., BeO or MgO, probably could be applied by the same techniques. ***A. K. Smalley, W. C. Riley, and W. H. Duckworth.*** *American Ceramic Society Bulletin,* v. 39, July 1960, p. 359-361.

11062 Ceramic Materials for Nuclear Reactor Controls and Poison. Materials being used and considered for application to nuclear reactor control and burnable poison components are described. The most important are B_4C and the four lanthanon oxides of Eu, Gd, Sm, and Dy. Neutron absorbing glass compositions based on the cadmium-rare earth-borate system also are under consideration. ***George L. Ploetz.*** *American Ceramic Society Bulletin,* v. 39, July 1960, p. 362-365.

11063 Sintering of Uranium Oxide in the Range of 1200-1300°C. Because of the increased sinterability of uranium oxide with an O/U ratio of 2.30 to 1, pellets of over 95% theoretical density were obtained after sintering at 1300 C. The nonstoichiometric uranium oxide mixture was prepared by blending UO_2 with U_3O_8. The sintered pellets were reduced to stoichiometric composition with H at a temperature of over 1200 C. Manufacture of the pellets is based on pilot-plant production operations. ***Kasimir Langrod.*** *American Ceramic Society Bulletin,* v. 39, July 1960, p. 366-369.

11064 Microstructural Changes in Titanium Carbide-Base Cermets at 2000°F. Samples of Kentanium K-151-A and K-152-B were heat treated at 2000 F in an He atmosphere for varying periods of time to 1000 hr, then quenched in oil. The samples were examined by optical and quantitative microscopy, and X-ray diffraction techniques. The observed changes are in agreement with the expected changes in microstructure arising from a solid-state solution-precipitation process. The results suggest that, if the solution-precipitation process occurs under stress, strong nickel-carbide interfacial bonds will be replaced by weaker carbide-carbide bonds and the strength of the cermets at 2000 F will decrease. It was concluded that cermets having superior strength should result from a decrease in the solid solubility of the carbide phase in the nickel phase at 2000 F. ***Herbert W. Newkirk, Jr., Harry H. Sisler, and Thomas S. Shevlin.*** *American Ceramic Society Bulletin,* v. 39, July 1960, p. 370 + 4 pages.

11065 A Study of Commercial Periclases. Nine commercial periclases were studied chemically, physically, and petrographically. One of the periclases was made from magnesite, one from brucite, three for sea water, and four from brine. The magnesia content ranged from 88 to 98%, and the bulk density ranged from 3.01 to 3.28 gm per cc. The variation of silicate content and magnesia-crystal size within well-sintered periclase has indicated that rotary kilns can be used to produce periclase of higher purity than the current product. ***D. H. Hubble and N. B. Dodge.*** *American Ceramic Society, Journal,* v. 43, July 1960, p. 343-347.

11066 Solid Solution Dielectrics Based on Sodium Niobate. Dielectric properties of some 20 solid solution systems are described, the additives being classified into ABO_3, AB_2O_6, and $A_2B_2O_7$ types. Properties of the systems $NaNbO_3$-$BaTiO_3$, $NaNbO_3$-$SrTiO_3$, and $NaNbO_3$-$Sr_2Ta_2O_7$ are described. ***R. M. Glaister.*** *American Ceramic Society, Journal,* v. 43, July 1960, p. 348-353.

11067 The Structure of Some B_2O_3-H_2O Glasses. Consideration of the results of complementary infrared and nuclear magnetic resonance studies along with preliminary results of physical property measurements indicates that the glasses of high water content are heterogeneous. It is probable that disordered regions of high H bond density, approaching HBO_3 in composition, are embedded in a matrix approximating vitreous B_2O_3. ***F. Meller and M. E. Milberg.*** *American Ceramic Society, Journal,* v. 43, July 1960, p. 353-356.

11068 Effect of Water Content on Corrosion of Borosilicate Glass. Several glass smelting methods were employed to produce an alkali borosilicate glass with various amounts of water within the body of the glass. Infrared studies in the region 2.7 to 3.0 μ showed that a decrease in the O-H groups in the glass resulted in a decrease in the amount of absorption in this region. A correlation between water content and corrosion resistance is shown. ***D. K. Priest and A. S. Levy.*** *American Ceramic Society, Journal,* v. 43, July 1960, p. 356-358.

11069 Mechanical Properties of Magnesia Single Crystals in Compression. Stress-strain curves are given at temperatures from −196 to 1200 C; curves are also shown for different rates of loading at room temperature. The crystals show considerable ductility at all temperatures, and at room temperature can be deformed plastically about 6% before fracture at stresses. Heat-treatment has an appreciable effect on the yield stress. The resistance of the material to deformation increases with the number of slip systems and bands activated. At about 2-3% strain, stress concentrations begin to be relieved by small internal cracks which are not easily propagated. Preliminary creep tests above the macroscopic yield stress and in the temperature range 800 to 1000 C show large instantaneous plastic deformations followed by slow constant-rate creep. ***Charles O. Hulse and Joseph A. Pask.*** *American Ceramic Society, Journal,* v. 43, July 1960, p. 373-378.

11070 Electron Microscope Studies of Mullite Development in Fired Kaolinites. Preshadowed carbon replicas were used to follow changes in surface texture of poorly crystallized and well crystallized kaolinites after firing to various temperatures between 850 and 1200 C. X-ray diffraction was used for phase identification. Mullite was observed consistently in preferred orientation on the large well crystallized kaolinite stacks but not on poorly crystallized specimens. ***Joseph J. Comer.*** *American Ceramic Society, Journal,* v. 43, July 1960, p. 378-384.

11071 Antimonate Glass for Infrared-Transmitting Windows. A glass composition containing 63% Sb_2O_3 and 15% Al_2O_3 was developed which had improved transmission characteristics at wavelengths between about 4 and 6 μ. ***W. A. Hedden and B. W. King.*** *American Ceramic Society, Journal,* v. 43, July 1960, p. 387-388.

11072 The Observation of Fatigue Processes in MgO Single Crystals. Under cyclic stress, dislocations move irreversibly, they multiply, slip bands form and grow, cracks nucleate and propagate, and failure occurs. The use of ionic crystals such as MgO is advantageous in such investigations because they are optically transparent. Individual dislocation intersections with $\{100\}$ surfaces may be observed with a standard microscope, using etch-pit techniques. Slip, deformation, crack formation, and fracture in MgO crystals under cyclic stress are compared with corresponding processes in metals. ***I. Cornet and A. E. Gorum.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 3, June 1960, p. 480-485.

11073 The Cement Reference Laboratory. Covers the origin, purpose, and development of each of the present responsibilities of this installation. ***J. R. Dise.*** *American Society for Testing Materials, Proceedings,* v. 59, 1960, p. 369-377. (TA401 Am35p Vis.)

11074 An Approach to the Problem of Evaluation of Plasticity and Workability of Pastes and Mortars. Measurements were made of the rates of deformation of hemispherical specimens of pastes and mortars when tested on the flow table. The deformation was recorded for each drop of the table and the change in per cent flow was used as a measure of the deformation. ***A. D. Conrow.*** *American Society for Testing Materials, Proceedings,* v. 59, 1960, p. 1075-1090. (TA401 Am35p Vis.)

11075 Quantitative Determination of the Four Major Phases in Portland Cements by X-Ray Analysis. Because the combined X-ray and chemical analysis method is the most accurate method available at present for the estimation of the four phases, it has been adopted as a standard, and the values for the phases obtained by the three other available methods (X-ray method, microscopical analysis and potential compound calculation) have been compared with it. The X-ray method is more accurate than the two older methods. ***Stephen Brunauer, L. E. Copeland, D. L. Kantro, C. H. Weise, and Edith G. Schulz.*** *American Society for Testing Materials, Proceedings,* v. 59, 1960, p. 1091-1100. (TA401 Am35p Vis.)

11076 Acetate Processed Portland Cement. A study of organic acids disclosed that acetic acid had the unique property of creating a free-flowing dry cement and did not, in any measurable manner, alter other properties of the cement. The reaction of acetic acid with Portland cement produces calcium acetate, and forms a completely dispersed surface coating of calcium acetate on the cement grains. ***B. E. Kester.*** *American Society for Testing Materials, Proceedings,* v. 59, 1960, p. 1111-1119. (TA401 Am35p Vis.)

11077 Clays and Clay Minerals. Proceedings of the Seventh National Conference on Clays and Clay Minerals. Discusses clay minerals in saline waters, effect of sea-water on clay minerals, rapid dissolution of allophane and kaolinite-halloysite after dehydration, formation of chlorite-like structures from montmorillonite, pretreatment of soils and clays for measurement of external surface area by glycerol retention, and other problems. ***Earl Ingerson, editor.*** v. V. 369 pp. 1960. Pergamon Press, New York. (TN941 N21c)

11078* Aging of Rutile Ceramic. On the basis of a study of aging on material T-80, it is shown that rutile ceramic is relatively resistant to prolonged heating and ages only under the effect of an electric field. Increasing the partial O pressure in the firing zone in comparison with atmospheric pressure did not cause any decerase of the aging property of the material. (*In Russian.*) Starenie rutilovoĭ keramiki. ***V. Ia. Kunin, Iu. A. Polonskiĭ, and A. N. Tsikin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Fizika,* 1960, no. 2, p. 85-89.

11079* Magnetic Characteristics of Lithium-Aluminum Ferrites. $Li_{0.5}Fe_{2.5-x}Al_xO_4$ tests revealed that when "a" changes from 0 to 1, the saturation magnetization varies within large limits. The Curie temperature changes only from 640 to 470 C. The variation of magnetization corresponds to the assumption that the Al ions occupy octahedral positions. (*In Russian.*) Magnitnye kharakteristiki litiĭ-aliuminievykh ferritov. ***A. S. Khlystov and S. M. Zhiliakov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Fizika,* 1960, no. 2, p. 151-153.

11080* Some Properties of the $Li_2O \cdot xFe_2O_3$ System. Investigations of these ferrites, where x = 1, 2, 3, 4, 5, and 6, revealed that the $Li_2O \cdot 5Fe_2O_3$ compound possesses lowest coercive force and maximum magnetic permeability, induction angle of rotation of the plane of polarization, and high-frequency quality factor. (*In Russian.*) Nekotorye svoĭstva sistemy $Li_2O \cdot xFe_2O_3$. ***N. A. Smol'kov and V. M. Grekov.*** *Moscow, Universitet, Vestnik, Seriia Matematiki, Mekhaniki, Astronomii, Fiziki, Khimii,* 1959, no. 6, p. 137-141.

11081* Penetration of Water Into the Clinker Grain. For several cements, the depth of water penetration was computed from measurements of the heat of hydration and from the statistical analysis of particle size and shape. Lower penetration values were found for cements with low C_3A content, higher values for cements containing more fine particles or a small addition of K_2SO_4. (*In French.*) La pénétration de l'eau à l'intérieur du grain de clinker. ***A. R. Steinherz.*** *Revue des Matériaux de Construction,* 1960, no. 536, May, p. 119-125.

11082* A Contribution to the Study of Viscosity in Glasses. Influence of temperature on viscosities in the range from 10^9 to 10^7 Po was determined on plain, optical, and organic glasses. Structural considerations help in interpreting the effects of composition on the absolute value of viscosity. The energy of activation of the viscous flow process and the relationship between the variation of viscosity and that of density as a function of time are examined. (*In French.*) Contribution a l'étude de la viscosité des verres. ***Micheline Prod'homme.*** *Revue d'Optique Théorique et Instrumentale,* v. 39, no. 3, Mar. 1960, p. 95-135.

11083* Refractory Concretes With Barium-Alumina Cement as the Bonding Agent. The refractoriness and mechanical properties of barium alumina cement are proportional to the proximity of its composition to that of monobarium aluminate (SiO_2, Fe_2O_3, alkalis must be as low as possible). The conditions of solidification, refractoriness, resistance to sudden changes of temperature and improvement of refractoriness were examined.

(*In German.*) Feuerfeste Betone mit Barium-Tonerdezement als Bindemittel. ***Al. Braniski.*** *Revue Roumaine de Métallurgie*, v. 5, no. 1, 1960, p. 165-185.

11084* Microhardness and Grindability of Glasses. With low microhardness there is low wear and vice versa. The softer Pb and K glasses have a lower wear than the harder soda glasses. With glasses of the same elasticity, the glass with the highest microhardness has the highest wear. (*In German.*) Mikrohärte und Schleifbarkeit von Gläsern. ***Fred G. Wihsmann and Armin Petzold.*** *Silikattechnik*, v. 11, Apr. 1960, p. 151-153.

11085 Nondestructive Tests for Ceramic, Cermet and Graphite Materials. A feasibility study of several nondestructive tests as methods for predicting performance characteristics of ceramic, cermet, and graphite materials was carried out. In the absence of viscous or plastic flow, external flaws were found to markedly affect material strength, whereas internal flaws were, in some cases, found to be of secondary importance. Static strengths of alumina bodies correlated well with particle sizes as determined by X-ray back reflection. ***Julian H. Lauchner, Dwight G. Bennett, and George L. Morgan.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-412, Nov. 1959, 52 pp. (TL507 Un3.18w Vis.)

See also: **11628** (photosensitive glass).

CHEMICAL ENGINEERING

11086 Concurrent Gas Absorption Mass Transfer. May be used to practical advantage when liquid partial pressure is minor. ***W. S. Dodds, L. F. Stutzman, B. J. Sollami, and R. J. McCarter.*** *A.I.Ch.E. Journal*, v. 6, no. 2, June 1960, p. 197-201.

11087 Elutriation of Solid Particles From a Dense-Phase Fluidized Bed. Materials used are glass beads and coal powder with air and He as the elutriating gases. ***Chin-Yung Wen and Richard F. Hashinger.*** *A.I.Ch.E. Journal*, v. 6, no. 2, June 1960, p. 220-226.

11088 The Compressibility of Carbon Dioxide-Argon Mixtures. Compressibility factor has been measured at 50 C and 50 to 1,000 atm. for each of seven mixtures of CO_2 and Ar containing 12.9 to 83.1 mole % CO_2. ***William H. Abraham and C. O. Bennett.*** *A.I.Ch.E. Journal*, v. 6, no. 2, June 1960, p. 257-261.

11089 Mechanisms by Which Ultrasonic Energy Affects Transfer Rates in Liquid-Liquid Extraction. Insonation has a positive effect on mass transfer in both concurrent and spray-tower operations. ***H. A. Woodle, Jr., and F. C. Vilbrandt.*** *A.I.Ch.E. Journal*, v. 6, no. 2, June 1960, p. 296-298.

11090* Organic Fouling of Anion-Exchange Resins. Organic fouling of anion-exchange resins proceeds by the exchange of large organic acids. Accumulation of the acids on resins limits the capacity of the resins for further exchange of the acids and inorganic ions present in raw water. Frequent brining and the use of scavenger beds appear to be most effective for control of organic fouling. ***Norman W. Frisch and Robert Kunin.*** *American Water Works Association, Journal*, v. 52, July 1960, p. 875-887.

11091 Ammonia. Manufacture and Uses. Demonstrates application on a large scale of principles ranging from the gas laws to simple thermodynamics. Presentation is for senior pupils in schools and junior students in technical colleges. ***A. J. Harding.*** 41 pp. 1959. Oxford University Press, New York. (TP223 H21a)

11092* Solvent Extraction of Phenol From Sulphite Liquors—Plant Design. Describes a special plant designed for extracting phenol from sulfite liquors followed by dephenolation of the extract with caustic soda since the process economics are dependent on the highest recovery of phenol and sodium sulfite. ***F. Molyneux.*** *Chemical & Process Engineering*, v. 41, June 1960, p. 223-227.

11093* Materials of Construction for Chemical Plant. Lead. Ease of workability and chemical resistance have made Pb one of the most versatile metals for chemical and nuclear plant. ***H. C. Wesson.*** *Chemical & Process Engineering*, v. 41, June 1960, p. 247 + 5 pages.

11094* Efficiency of a High Temperature Vaporizer. The fast reaction-type burner produced a more uniform gas temperature for the full furnace depth and resulted in somewhat greater furnace efficiency. The burner produces higher metal temperatures and can be utilized where high heat release rates are desirable. ***J. H. Born, Jr. and M. L. Jones.*** *Chemical Engineering Progress*, v. 56, July 1960, p. 39-44.

11095* Plastic Film Heat Exchangers. Substitution of plastics for metals in heat exchangers offers interesting technical and economic potential. A spirally wrapped evaporator, a circulating air-vapor evaporator, and a falling film evaporator are described. ***J. M. Weaver.*** *Chemical Engineering Progress*, v. 56, July 1960, p. 49-51.

11096* Economical Drying of Solids. Outlines drying methods and presents procedures and equations for designing commercial driers. To use the equations, it is necessary to carry out an experimental test in a constant-condition drier and to determine the critical free-moisture content. ***Herbert T. Bates.*** *Chemical Engineering Progress*, v. 56, July 1960, p. 52-57.

11097* Solar Heat Exchangers. Up-to-the-minute results of studies on methods to improve performance and reduce costs are given. ***J. A. Duffie, G. O. G. Löf, and E. M. A. Salam.*** *Chemical Engineering Progress*, v. 56, July 1960, p. 63-67.

11098* Froth Flotation: The Adhesion of Solid Particles to Flat Interfaces and Bubbles. Equations derived for the force and work required to detach the particle from the interface as functions of the solid and liquid densities, the surface tension, and the angle of contact. ***C. W. Nutt.*** *Chemical Engineering Science*, v. 12, no. 2, May 1960, p. 133-141.

11099* Heat Transfer Studies Between Particles and Liquid Medium in a Fluidized Bed. The heat-transfer coefficients between the particles and the fluidizing medium under unsteady state conditions are determined by transient heating of cold water stream, with hot solid particles dropped into the fluidizing bed, in a specially designed liquid fluidizing column. Heat-transfer coefficients varying for 113 to 620 B.t.u/hr/ft²/°F are obtained, and these values increase with increase in particle diameter and mass velocity. ***Narsimha Rao Sunkoori and Ramalingam Kaparthi.*** *Chemical Engineering Science*, v. 12, no. 3, June 1960, p. 166-174.

11100* Mass Transfer From Drops and Bubbles. Reports experimental values and semi-theoretical formulae for the rates of solution of drops and bubbles under forced convection conditions. The effect of surface active agents on the mass transfer rate is discussed and pertinent experimental data are presented. ***R. M. Griffith.*** *Chemical Engineering Science*, v. 12, no. 3, June 1960, p. 198-213.

11101 Chemical Technology of Petroleum. Discusses production, classification and description of crude oils, composition of petroleum and petroleum products, chemical reactions and group reactions, physical properties, origin of petroleum, distillation, refining by chemical methods, refining by physical methods, cracking of petroleum oils, chemical thermodynamics of petroleum hydrocarbons, gasoline and other motor fuels, kerosene, absorbent oils, and other problems. ***William A. Gruse and Donald R. Stevens.*** 3rd Ed. 675 pp. 1960. McGraw-Hill, New York. (TP690 G92c3)

11102* Kinetics of Milling. For "differential milling" only, there may exist relations with the kinetics of the reaction because, in that case, certain reaction processes may be coordinated with the speed equation. This application of kinetics is justified and explained by 3000 milling experiments carried out in various conditions. (*In French.*) Cinétique du broyage. ***F. Patat.*** *Chimie & Industrie (Génie Chimique)*, v. 83, no. 3, Mar. 1960, p. 61-74.

11103* Use of Tracers in Industrial Research. By injecting tracers into continuous-flow systems, it is possible to find the distribution of residence times of the material flowing through the system, and also its flow-rate and the quantity held-up in

the system. It is also possible to explore the flow-pattern of the material and detect regions of stagnation, channelling, or reverse flow. (*In French.*) L'utilisation de traceurs dans les recherches industrielles. ***P. V. Danckwerts.*** *Chimie & Industrie (Génie Chimique)*, v. 83, no. 3, Mar. 1960, p. 75-80.

11104 Drying Agents for Low-Boiling Aromatic Hydrocarbons. Calcium sulfate is the agent of choice. *Coal Tar Science*, no. 8, 1960, p. 21-24.

11105 Usefulness of Rheology in Cosmetics. Application of academic studies to practice. ***Herbert Heinrich and John Clements.*** *Drug and Cosmetic Industry*, v. 86, no. 6, June 1960, p. 760 + 7 pages.

11106* Automation Trends in Orifice Meter Measurement and Gas Dispatching. Latest meters and secondary instruments are discussed, as well as the kinds of computers that might be employed. A system with a second program taking stored data from a chart scanner and calculating accounting volumes in the time between decision-making chores was chosen. ***G. J. Sandusky.*** *Gas Age*, v. 125, June 23, 1960, p. 15-19.

11107* Industrial Water Use. A Review. Quantity of water used, types of industrial use, quality and sources. ***Gilbert F. White.*** *Geographical Review*, v. 50, no. 3, July 1960, p. 412-430.

11108* Stabilization of Soil With Calcium Chloride. A compilation of abstracts of the major portion of the literature on stabilization with $CaCl_2$. About 450 references are presented. ***Floyd O. Slate and A. W. Johnson.*** *Highway Research Board, Bibliography* 24, 1958, 96 pp. (TE1 H53b Abstract Room)

11109* Converting Viscosity Units. Conversion formulae are cited. There is no unit for kinematic viscosity in English units. Generally, the conversion is made by changing cm^2/sec to in^2/sec, or more simply by dividing centistokes by 644. ***R. W. Black.*** *Hydraulics & Pneumatics*, v. 13, July 1960, p. 78 + 1 page.

11110 An Improved Commercial Fluorine Cell. Improvements to the anode connection of commercial fluorine cell results in increasing cell life by 2 to 5 times. Cumulative experiences, favorable and unfavorable, are valuable to all who are concerned with the design and operation of commercial fluorine cells. ***C. A. Powell, R. E. Cable, and W. K. Henderson.*** *Industrial and Engineering Chemistry*, v. 52, July 1960, p. 46A-51A.

11111 Pump Theory. A review of pumping theory can serve as an excellent guide in the design and selection of pumps for chemical service. ***Edward J. Serven, Jr. and R. R. Rhodes.*** *Industrial and Engineering Chemistry*, v. 52, July 1960, p. 557-560.

11112 Producing Natural Gas Substitutes From Petroleum by Continuous Pressure Hydrogenolysis. High yields of olefin-free, 800 to 1000 Btu./SCF fuel gas were obtained at 500 to 1500 psig. and 1400 F by continuous hydrogasification of distillate oils or their equivalent. The only by-products are about 10% (weight) low boiling aromatics, primarily benzene. ***E. B. Shultz, Jr., N. Mechales, and H. R. Linden.*** *Industrial and Engineering Chemistry*, v. 52, July 1960, p. 580-583.

11113 Pipeline Gas by Methanation of Synthesis Gas Over Raney Nickel Catalyst. In 1-inch diameter reactors, about 20,000 SCF of methane per pound of original alloy were produced in 1200 to 1500 hr. at 75 to 150 psig from purified synthesis gas with a 3 to 1 H:CO ratio. ***H. A. Dirksen and H. R. Linden.*** *Industrial and Engineering Chemistry*, v. 52, July 1960, p. 584-589.

11114 Carbon Black From Flames of Oxidants in Hydrocarbons. With chlorine as oxidant the C was found to contain substantial amounts of chemically-bonded Cl. Chlorocarbon blacks obtained in this way differ in composition and probably in basic structure from ordinary blacks. ***C. Bryant Bachman and Herbert I. Berman.*** *Industrial and Engineering Chemistry*, v. 52, July 1960, p. 621-624.

11115* Equipment for the Resuspension or Redissolving of Precipitates in Continuous-Flow Centrifuges. Precipitates are separated without first removing them from the centrifuge bowl. Equipment has been used in preparation of human plasma fractions. ***L. Vallet.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 2, no. 2, June 1960, p. 121-127.

11116* Handling of Antifoam Oils for Fermentations. Antifoam oils may be synthetic, such as silicones or polyglycols, or natural, such as lard oil or soybean oil. Either will substantially change the physical structure of foam, principally by reducing surface elasticity. ***H. R. Bungay, C. F. Simons, and P. Hosler.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 2, no. 2, June 1960, p. 143-155.

11117* Selection of a Catalyst for Cracking Residual Petroleum Fractions and Study of Its Contaminating Effects in the Process. Catalytic cracking of residual petroleum fractions with a raw microspherical catalyst is carried out with stable characteristics, irrespective of the contaminating effect of the catalyst by the metals contained in the raw material. A very simple raw catalyst is used. Stable working of the catalyst is obtained by water vapor. (*In Russian.*) Vybor katalizatora dlia krekinga ostatochnykh fraktsiĭ nefti i izuchenie ego otravleniia v protsesse. ***A. V. Agafonov, I. E. Gel'ms, and E. I. Rabinovich.*** *Khimiia i Tekhnologiia, Topliv i Masel*, v. 5, no. 6, June 1960, p. 6-12.

11118* Bentonite in Industry. Properties of bentonite, production and processing, industrial uses, oil well drilling mud, use in foundries, oil well cements, use as a fire retardant are discussed. ***Fred Chisholm.*** *Mines Magazine*, v. 50, July 1960, p. 30 + 6 pages.

11119* Kraft Pulping of Sawdust and Shavings in a Pandia Digester. Indicates that continuous cooking will eventually replace stationary digesters. The use of this type of continuous digester permits the utilization of large quantities of sawmill waste not otherwise possible. *Paper Trade Journal*, v. 144, July 4, 1960, p. 28-29.

11120* A New Type of Reactor for Ammonia Synthesis. Operates at a pressure of 300 atm. The catalyst occupies an uncommonly large proportion of the pressure vessel capacity (52.5%). The reactor assures high stability of work due to the low temperature span of the catalyst bed. Principles of design and the experience obtained are discussed. (*In Polish.*) Nowy typ reaktora syntezy amoniaku. ***Wacław Hennel.*** *Przemysł Chemiczny*, v. 39, no. 4, Apr. 1960, p. 241-245.

11121* Selecting Paper Stock Pumps. Points out that impeller design alleviates size problems and that stock is the key to air entrainment. ***A. E. Risk.*** *Pulp and Paper Magazine of Canada*, v. 61, June 1960, p. 103-105.

11122* Synthesis of Diamond. Describes the work of Moissan, Hannay, Bridgeman, General Electric, Swedish and South African scientists. The secret of all these successful syntheses of diamond is the ability to produce high temperatures and ultra-high pressures simultaneously and continuously throughout a reasonably large volume of space. ***D. P. Mellor.*** *Royal Australian Chemical Institute, Proceedings*, v. 27, May 1960, p. 208-215.

11123* The Water Supply System of an Iron and Steel Works. Describes cooling system of the blast furnaces, gas scrubbers, slag granulation, O plant, sintering plant, and rolling mill. Advantages of a central pumping station. Relief of the water courses carrying-off the waste water. (*In German.*) Wasserwirtschaft eines gemischten Hüttenwerkes. ***Eberhard Knecht.*** *Stahl und Eisen*, v. 80, no. 11, May 26, 1960, p. 751-756.

11124 Resistance in Pipelines of Hydraulic Transport Installations. Analytic methods for calculating the resistance of pulp streaming under pressure in the pipelines of hydraulic transport installations are not very reliable. Comparison discloses serious discrepancies. (*In Czech.*) Poznámky k teorii odporů hydrosměsí v potrubí. ***J. Novák.*** *Strojírenství*, v. 10, no. 5, May 1960, p. 345-348.

11125 Thermodynamic Principles for Chemical Engineers. Approaches the study of thermodynamics by graphical methods of calculation and furnishes an up-to-the-minute discussion of the flow process and the irreversible thermodynamic process which dominate industrial and engineering applications of chemistry today. ***Roger Gilmont.*** 339 pp. 1959. Prentice-Hall, Inc., Englewood Cliffs, N. J. (QD501 G42t)

11126* Controlled Drying of Granular Substances. Selected industrial drying methods and their control problems are demonstrated. (*In Norwegian.*) Kontrollert tørking av granulater. ***Ole Myklestad.*** *Tidsskrift for Kjemi, Bergvesen og Metallurgi*, v. 20, no. 5, 1960, p. 95-98.

11127 Diffusion Coefficients in Multicomponent Solvents. The diffusion coefficient, viscosity products for the *n*-hexane-*n*-tetradecane, *n*-hexane-cyclohexane, and cyclohexane-*n*-decane solvent mixtures were best correlated as a linear function of the solvent composition expressed in mol fraction. ***John Thomas Holmes.*** *U. S. Atomic Energy Commission, UCRL*-9145, Apr. 1960, 51 pp. (UF767 U3u Contin.)

11128 Longitudinal Dispersion in Beds of Finely Divided Solids. Experimental determinations of the longitudinal dispersion coefficient and the Peclet number were made for three binary gas systems. The experimental technique involves measuring the dispersion of a step function input to a column packed with glass beads. ***Jerry Max Robinson.*** *U. S. Atomic Energy Commission, UCRL*-9193, June 1960, 56 pp. (UF767 U3u Contin.)

11129 Investigation of the Natural Frequencies of Fluids in Spherical and Cylindrical Tanks. The configurations included spheres and circular cylinders that could be oriented with respect to the direction of oscillation. ***John Locke McCarty and David G. Stephens.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-252, May 1960, 20 pp. (TL570 Un3t Vis.)

11130* Phenol-Cyanide Removal in a Plastic-Packed Trickling Filter. A new type of equipment for the disposal of coke-oven wastewaters. Data obtained from pilot-plant operation show consistent removals of 95% for phenol and 90% for cyanide. ***J. A. Porter and P. H. Dutch.*** *Water Pollution Control Federation, Journal*, v. 32, June 1960, p. 622-631.

See also: **11181** (metal organic compounds in industry); **11340** (chemical industry personnel); **11348** (water treatment); **11391** (in-line fuel oil blending); **11393** (petroleum coking processes); **11399** (leonardite utilization); **11526** (high-alloy tray for crude oil fractionator).

CHEMISTRY—ANALYTICAL

11131* Gas-Liquid Chromatography of Fatty Derivatives. III. Analysis of Fatty Amines. Separation and quantitative determination of saturated fatty amine samples of carbon-chain length ranging from C_8 through C_{22}, using nonpolar liquid substrates on either Chromosorb W or Chromosorb solid supports previously treated to reduce their adsorptivity, is described. ***W. E. Link, R. A. Morrissette, A. D. Cooper, and C. F. Smullin.*** *American Oil Chemists' Society, Journal*, v. 37, July 1960, p. 364-366.

11132 The Analysis of Fats and Oils. Brings together such methods (standardized and nonstandardized) and analytical information as are useful to the fat and oil analyst who is concerned with problems of production control and trading specifications. ***V. C. Mehlenbacher.*** 616 pp. 1960. The Garrard Press, Champaign, Ill. (TP671 M47a)

11133* The Determination of Vitamin B_{12}. Critical review of physical and chemical methods of determination. ***W. H. C. Shaw and Christine J. Bessell.*** *Analyst*, v. 85, June 1960, p. 389-409.

11134 The Electron Probe: An Added Dimension in Chemical Analysis. Quantitative analyses may now be performed on less than 1 $\mu\mu$g of material in any selected one square micron area on a specimen surface. The limit of detectability is about 0.1% and all elements above atomic number 11 are suitable for measurement. The development of the electron probe microanalyzer concept is based on a beam of 10 to 50 KeV electrons which are focused on a one-micron diameter spot on the surface of a solid specimen. The electrons generate the characteristic X-ray spectral lines from the elements present in the one-micron spot to a depth of about one micron below the surface. Standard X-ray optics are used to measure the spectral intensity. Applications where the method is used include segregations in alloys and minerals, diffusion or corrosion zones, and thin surface layers. ***L. S. Birks.*** *Analytical Chemistry*, v. 32, Aug. 1960, p. 19A + 6 pages.

11135 The Analysis of Low Boiling Tar Acids by a Silylation Technique and Gas Chromatography. Technique proposed involving the conversion of the phenols to their trimethyl silyl ethers, followed by the use of gas chromatography to separate these derivatives. By studying the results of the chromatograms obtained, in conjunction with those for the original tar acids, it is possible to get an almost complete analysis, leaving unknown only the concentrations of 3,5-xylenol and m-ethyl phenol. ***D. W. Grant.*** *Coal Tar Research Association, Report No.* 0254, May 25, 1960, 7 pp. (TP953 C63 Contin.)

11136* The Identification of Teepol and Sodium Lauryl Sulphate in a Commercial Detergent Mixture. Method involves the hydrolysis of the product and extraction of the mixed alcohols. The 3·5-dinitrobenzoate esters are then prepared and chromatogrammed in benzene, a hydroxylamate staining technique being used. ***B. Sewell.*** *Laboratory Practice*, v. 9, June 1960, p. 381.

11137* Acid-Base Titrations in Nonaqueous Solvents. Principles and examples of nonaqueous acid-base titrations are reviewed. Research on two methods that use acid-base titrations for measurement: determination of carbonyl compounds by oximation, and determination of alcohols and organic hydroxyl groups by acetylation. ***James S. Fritz.*** *Record of Chemical Progress*, v. 21, no. 2, June 1960, p. 95-106.

11138* Electrochemical Methods of Ultramicroanalysis. ***I. P. Alimarin and M. N. Petrikova.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 79, June 1960, p. 491-494.

11139* The Microchemistry of the Platinum Metals. Separation and Determination of Micro Amounts of Rhutenium, Rhodium and Palladium. Method based on reactions of platinum metals with 8-hydroxyquinoline. Determinations are carried out spectrophotometrically on the metal oxinate extract in chloroform. The procedure gives reproducible results and provides a rapid method for the determination of each of the three elements even in their mixtures. ***Fadhil Jasim, Robert J. Magee, and Cecil L. Wilson.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 79, June 1960, p. 541-550.

11140* The Determination of Tungsten in High Alloy Steels by Isotope Dilution. Procedure using W-185 developed for the determination of W in high alloy steels. Tungsten is determined spectrophotometrically with hydroquinone in H_2SO_4 medium, after homogeneous precipitation from a HNO_3-H_2O_2 solution. ***G. Leliaert, J. Hoste, and Z. Eeckhaut.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 79, June 1960, p. 557-566.

11141 The Routine Analysis of Copper Base Alloys. Written for the laboratory worker, whether chemist or semi-trained technician. ***Frank J. Versagi.*** 168 pp. 1960. Chemical Publishing Co., New York. (QD137.C6 V61r)

11142 Flame Spectrophotometric Determination of Calcium in Lead Metal. Determination of Ca in lead metal in the range of 0.02 to 0.1 per cent has been developed. The method requires a minimum of sample preparation and time. Measurement of the 554 mμ calcium emission provided a limit of error (0.95) of $\pm$4.2%. ***Roscoe E. Barringer.*** *U. S. Atomic Energy Commission*, Y-1295, Mar. 22, 1960, 21 pp. (UF767 Un3.1y Contin.)

11143* Oxidations With Potassium Permanganate in the Presence of Fluoride. III. Determination of Chromium(III) and Vanadium(IV). Trivalent chromium and quadrivalent vanadium can be determined with fair accuracy by a method consisting in mixing either with an excess of $KMnO_4$ in the presence of alkali hydroxide. After leaving the mixture for 5 min, the solution is acidified with sulfuric acid and mixed with NaF solution. An excess of monovalent mercury Hg_2^{2+} solution is then added, the solution heated to 40 C, and then titrated with $KMnO_4$ solution in the presence of Cu^{2+} ions to conceal the pink manganic fluoride color. ***I. M. Issa and M. Hamdy.*** *Zeitschrift für Analytische Chemie*, v. 174, no. 6, 1960, p. 418-422.

11144* A Contribution to the Spectroscopic ^{15}N-Determination by Using a Step Filter. The usual method was modified by using a step filter in measuring the intensity of the N_2 isotope molecules. This simple and rapid procedure gives $\pm$2% accuracy.

The operation and effects on reproducibility were described. (*In German.*) Zur spektroskopischen ^{15}N-Bestimmung unter Verwendung eines Stufenfilters. ***H. Faust.*** *Zeitschrift für Analytische Chemie,* v. 175, no. 1, 1960, p. 9-18.

See also: **11075** (X-ray analysis of Portland cement); **11665** (microanalysis of inclusions in steel); **11856** (analysis of air pollutants).

CHEMISTRY—INORGANIC AND GENERAL

11145 Advances in Fluorine Chemistry. Discusses the halogen fluorides—their preparation and uses in organic chemistry, transition metal fluorides and their complexes, fluoroboric acids and their derivatives, the electrochemical process for the synthesis of fluoro-organic compounds, and exhaustive fluorinations of organic compounds with high-valency metallic fluorides. ***M. Stacey, J. C. Tatlow, and A. G. Sharpe.*** v. I. 203 pp. 1960. Academic Press, Inc., New York. (QD181.F1 Ad95 Vis.)

11146 Mixed Halogen Acids of the Elements of the II and III Periodic Groups. Preparation and some properties for the etherated complex mixed halogen acids of formula $H[Me^{III}X_3X']$ and $H[MeX_2X']$; the metals contained are Zn, Cd, Hg of group II and Al, Ga, In of group III. ***Andreas G. Galinos.*** *American Chemical Society, Journal,* v. 82, June 20, 1960, p. 3032-3033.

11147* Concerning a Sodium-Uranium(V)-Fluoride, Na_3UF_8. Through fluorination of trisodium-uranium(IV)-fluoride at 390 C, it was possible to obtain the almost colorless trisodium-uranium(V)-fluoride with 95% purity. When $Na_3UF_7 \rightarrow Na_3UF_8$, the free anion places in the U(IV) compound become occupied by F. The magnetic moment is calculated. (*In German.*) Über ein Natrium-uran(V)-fluorid, Na_3UF_8. ***Walter Rüdorff and Hans Leutner.*** *Annalen der Chemie (Justus Liebigs),* v. 632, nos. 1-3, 1960, p. 1-7.

11148* Contribution to the Study of Chloro-, Bromo- and Iodophosphates. Systematic study of the reactions of phosphoric acid and its calcium salts on calcium chlorides and calcium bromides, as well as on calcium iodide. Three new bromophosphates and one new iodophosphate were synthesized. Their stability and thermogravimetric decomposition were examined. The solid phases were identified by X-rays and compared, resulting in analogies of formulas and isomorphism. (*In French.*) Contribution a l'étude des chloro, bromo et iodophosphates de calcium. ***Jean-Pierre Vincent.*** *Annales de Chimie,* v. 5, May-June 1960, p. 579-599 + 4 plates.

11149 Indium Phosphates: Phase-Diagram, Ion-Exchange, and pH Titration Studies. ***C. E. A. Brownlow, J. E. Salmon, and J. G. L. Wall.*** *Chemical Society, Journal,* 1960, June, p. 2452-2457.

11150* The Borazoles. Synthesis, reaction mechanisms, and physical properties. ***J. C. Sheldon and B. C. Smith.*** *Chemical Society, Quarterly Reviews,* v. 14, no. 2, 1960, p. 200-219.

11151 The Reaction of Alkali Tungstate Solutions With Hydrochloric Acid. Careful electrometric and conductometric data are presented which make possible a direct comparison of the results of earlier workers in different concentration ranges. In this way, previous small discrepancies are resolved and the previously accepted notion of an unstable "para" ion and strong "meta" ion is further confirmed. ***P. Cannon.*** *Journal of Inorganic and Nuclear Chemistry,* v. 13, nos. 3-4, May 1960, p. 269-274.

11152 Reactions of Iodine in Liquid Ammonia. Products of the interaction of iodine and liquid ammonia at −75° are NH_4I and $NI_3 \cdot 12NH_3$; at −33.5° a (probably) less highly ammoniated NI_3 is the stable solid phase, while at 25° iodine oxidizes ammonia to elemental nitrogen. ***G. W. Watt and D. R. Foerster.*** *Journal of Inorganic and Nuclear Chemistry,* v. 13, nos. 3-4, May 1960, p. 313-317.

11153 Chemistry of Phosphorus Aluminium Bonding: Dimethylphosphino-Aluminium Hydrides and Chlorides. ***A. B. Burg and K. Mödritzer.*** *Journal of Inorganic and Nuclear Chemistry,* v. 13, nos. 3-4, May 1960, p. 318-322.

11154 Relations Between Simple and Complicated Oxygen Acids. Relations between simple and complicated oxygen acids can only be completely understood in terms of a general knowledge of oxyanions. This same general knowledge is needed in order to complete our knowledge of simple oxygen acids. The study of complicated acids and their derivatives can be expedited by short-cut techniques adapted to survey procedures in order to make maximal use of the minimal amount of definitive structural information that can be made available in a limited time. A tentative terminology has been suggested for complicated oxygen acids and their derivatives which has some advantages over present terminology. ***Jack J. Bulloff.*** *Ohio Journal of Science,* v. 60, no. 3, May 1960, p. 129-143.

11155 Sodium Chloride—The Production and Properties of Salt and Brine. Monograph bringing together all modern data on the sources, production, properties, and uses of salt and brines. ***Dale W. Kaufmann, editor.*** 743 pp. 1960. Reinhold Publishing, New York. (TN900 K16s)

11156 Reactions of Hydrogen Peroxide and Ion Exchange Resins. Interaction of dilute aqueous H_2O_2 and ion exchange resins. Mechanism of absorption and decomposition of H_2O_2 on anion exchange resin is proposed. ***Elizabeth W. Baumann.*** *U. S. Atomic Energy Commission, DP-*477, Apr. 1960, 30 pp. (UF767 Un3.1dp Contin.)

CHEMISTRY—ORGANIC

11157 The Alkaloids—Chemistry and Physiology. Indole, erythrina, quinoline, quinazoline, lupin, steroid, ipecac, isoquinoline, phthalideisoquinoline, bisbenzylisoquinoline, diterpenoid, and lycopodium alkaloids are reviewed. ***R. H. F. Manske, editor.*** v. VII. 559 pp. 1960. Academic Press, New York. (QD421 M31a)

11158 Magnetic Evidence Indicative of Structures and Structural Changes in Complexes of Cobalt(II). Magnetic data reported for bis-(*p*-toluidine)-cobalt(II)thiocyanate as a solid and in several solvents and for several isonitrile complexes of Co(II) can be used to infer certain features of stereochemistry and changes in stereochemistry of these substances. ***F. A. Cotton and R. H. Holm.*** *American Chemical Society, Journal,* v. 82, June 20, 1960, p. 2983-2986.

11159 Triorganoboranes as Alkylating Agents. Triethyl-, tri-*n*-hexyl- and triphenylborane are capable of alkylating mercuric salts to form the corresponding dialkyl- or diarylmercury compounds. The reaction was carried out in ethers and in aqueous solution. ***Julian B. Honeycutt, Jr. and James M. Riddle.*** *American Chemical Society, Journal,* v. 82, June 20, 1960, p. 3051-3052.

11160 Substitution and Addition Reactions of the Fluoroölefins. IV. Reactions of Fluoride Ion With Fluoroölefins. Potentially broad area of carbon-fluorine chemistry consists of reactions of the fluoroölefins which are brought about by fluoride ion with initial attack on unsaturated carbon. The importance and generality of such reactions is due to the high order of nucleophilic reactivity shown by fluoride ion toward fluoroölefins and to the unique structural relationships which are involved. ***William T. Miller, Jr., John H. Fried, and Harold Goldwhite.*** *American Chemical Society, Journal,* v. 82, June 20, 1960, p. 3091-3099.

11161 Dicarboxylation of Terphenyl. Friedel-Crafts reaction of terphenyl with oxalyl chloride gives a high yield of 4,4″-dicarboxyterphenyl. A number of derivatives of this acid were prepared, including a high molecular weight polyamide. ***Tod W. Campbell.*** *American Chemical Society, Journal,* v. 82, June 20, 1960, p. 3126-3128.

11162 Purine N-Oxides. VIII. N-Oxides of Azapurines. IX. Polarographic Studies. VIII. ***Marcus A. Stevens, Herman W. Smith, and George Bosworth Brown.*** IX. ***Francis A. McGinn and George Bosworth Brown.*** *American Chemical Society, Journal,* v. 82, June 20, 1960, p. 3189-3195.

11163* Ring Opening of Hydrofurfurans. 2-Phenyl-coumarans and 2-phenyl-tetrahydro furfurans can be dissociated in glacial acetic acid/acetic anhydride if traces of perchloric acid

are present. Hereby, 1 or 2 acetyl groups take place. Acetilated lignin shows the same phenomenon in about each third unit. (*In German.*) Ringöffnung bei Hydrofuranen. ***Karl Freudenberg, et al.*** *Annalen der Chemie (Justus Liebigs)*, v. 630, nos. 1-3, p. 1-9.

11164* 9.10-Dihydro-Anthracene Derivatives With Heterobridge Atoms. As a reactive dienophil dehydrobenzene can be used with suitable partners for the synthesis of dihydroanthracene derivatives with O, S or N as bridge atoms in the 9.10 position. (*In German.*) Über 9.10-Dihydro-Anthracen-Derivate mit Heterobrückenatomen. ***Georg Wittig, Erhard Knauss, and Konrad Niethammer.*** *Annalen der Chemie (Justus Liebigs)*, v. 630, nos. 1-3, 1960, p. 10-18.

11165* Elimination of Methoxylgroups by Hydration. On reduction of gallo-catechin-pentamethyl ether with sodium in ethanol, a methoxyl is substituted by hydrogen in contrast to the findings in catechin. The formation of a 1-[2.4.6-trimethoxyphenyl]-3-[3.5-dimethoxy-phenyl]-propane was found in the permethylated reaction product. (*In German.*) Über Eine Hydrierende Eliminierung von Methoxylgruppen. ***Walter Mayer, Günther Bauni, and Fritz Stolp.*** *Annalen der Chemie (Justus Liebigs)*, v. 630, nos. 1-3, 1960, p. 19-25.

11166* The Biosynthese of Terpene. VIII. Synthese of Δ^3-Isopentenol- Pyrophosphate. Δ^3-Isopentenic acid is reduced by $LiAlH_4$ to Δ^3-isopentenol. The latter can be converted by $POCl_3$ into the ester of orthophosphoric acid, the amide of which together with H_3PO_4 yields the pyrophosphoric ester. (*In German.*) Zur Biosynthese der Terpene. VIII. Synthese von Δ^3-Isopentenyl-Pyrophosphat. ***Hermann Eggerer and Feodor Lynen.*** *Annalen der Chemie (Justus Liebigs)*, v. 630, nos. 1-3, 1960, p. 58-70.

11167* Reduction and Reducing Methylation of 2-Methyl- and 1.2.3-Trimethyl-Naphthalene; Isopropylation of Naphthalene. 2-Methyl-naphthalene is reduced by sodium and ethanol or by sodium and liquid ammonium hydroxide to a mixture of Δ^1- and Δ^2-dihydro-2-methyl-naphthalene, whereby the former dominates. The reduction by the method Birch (with sodium in liquid ammonium hydroxide, together with ethanol) yields only a Δ^2 composition; at a high excess of sodium it yields 2-methyl-isotetralin. On reaction with sodium and methylbromide, dihydro-1.2.3-trimethyl-naphthalene results, which after repeated reducing methylation yields 1.2.3.4 tetramethyltetralin. In the result of reducing isopropylation of naphthalene, 1.4-diisopropyl-Δ^2-dihydronaphthalene is obtained, which then can be dehydrated to diisopropylnaphthalene. (*In German.*) Reduktion und Reduzierende Methylierung von 2-Methyl- und 1.2.3-Trimethyl-Naphthalin; Isopropylierung des Naphthalins. ***Walter Hückel, Rolf Cramer, and Siegmar Läufer.*** *Annalen der Chemie (Justus Liebigs)*, v. 630, nos. 1-3, 1960, p. 89-104.

11168* Description and Conversions of Mercaptomethyl- and of β-Mercaptoethyl-Ammonium Salts. Chloromethyl-acetyl-sulfide forms with trimethylamine trimethyl-acetyl-mercapto-methyl-ammonium chloride, but with pyridine acetyl-mercaptomethyl-pyridine-chloride, which by methanol-perchloric acid is converted into perchlorates. The scission of the acetyl remnant can be achieved by acid-catalyzed alcoholysis. (*In German.*) Darstellung und Umsetzungen von Mercaptomethyl- und β-Mercaptoäthyl-Ammoniumsalzen. ***Horst Böhme and Werner Schlephack.*** *Annalen der Chemie (Justus Liebigs)*, v. 630, nos. 1-3, 1960, p. 105-115.

11169* New Sulfur Containing Dyestuffs. Anetholtrithionine salt condenses with active methyl- and methylene compounds, forming monomethines and merocyanines; condensed with dimethylaniline, it forms the quinone dyestuff. Anils and hydrazones of anetholtrithionine forms with acetane hydride betaines of meso-substituted monomethine dyestuffs. (*In German.*) Neue Schwefelhaltige Cyaninfarbstoffe. ***Ulrich Schmidt, Robert Scheuring, and Arthur Lüttringhaus.*** *Annalen der Chemie (Justus Liebigs)*, v. 630, nos. 1-3, 1960, p. 116-119.

11170* Furfuranes and Thiophenes From α-β-Unsaturated Ketones. The forming of adducts menthofurfurane was investigated. Some furfuranes were synthesized by the W. Treibs method from cyclides-cyclanones over δ-sultones. Their diene-adducts can be dehydrated to hydroaromatics. Menthothiophene is obtained from pulegone-sultone. (*In German.*) Furane und Thiophene aus α.β-Ungesättigten Ketonen. ***Wilhelm Treibs.*** *Annalen der Chemie (Justus Liebigs)*, v. 630, nos. 1-3, 1960, p. 120-127.

11171* Unsymmetrical Three-Carbon Condensations. IV. Unsymmetrical Three-Carbon Condensation With Dibenzoyl Methane. In one operation, it is possible to condensate dibenzoyl methane into unsymmetrical products, so far unobtainable by other methods, by means of formaldehyde, malonic esters, or acylamino-malonic esters, nitromalonic ester, acetic acid ester, 2-acetamino-acetic acid ester, acetyl ketone, 3-acetamino-acetyl ketone, cyclopentanon-o-carbonic acid ester, cyclohexanon-o-carbonic acid ester, and bis-[ethyl sulfonyl]-methane. (*In German.*) Unsymmetrische Dreikohlenstoff-Kondensationen. IV. Unsymmetrische Dreikohlenstoff-Kondensationen Mit Dibenzoylmethan. ***Heinrich Hellmann and Dieter Dieterich.*** *Annalen der Chemie (Justus Liebigs)*, v. 632, nos. 1-3, 1960, p. 73-85.

11172* The Radiolysis of Cyclohexane. II. Cyclohexane-Cyclohexene Solutions and Pure Cyclohexene. γ-Radiolysis of cyclohexane-cyclohexene solutions and of pure cyclohexene yields of the two activated species in irradiated cyclohexane were confirmed. ***G. R. Freeman.*** *Canadian Journal of Chemistry*, v. 38, July 1960, p. 1043-1052.

11173* The Synthesis of Some Basic Esters of 3,4,5-Trimethoxybenzoic Acid. Basic esters obtained from the reaction of 2-chloroethyl and 3-chloropropyl 3,4,5-trimethoxybenzoate with secondary amines including 1,2,3,4-tetrahydro-β-carboline. The latter compound was prepared by the lithium-aluminum-hydride reduction of 1,2,3,4-tetrahydro-1-oxo-β-carboline. ***Gerassimos Frangatos, Geza Kohan, and Francis L. Chubb.*** *Canadian Journal of Chemistry*, v. 38, July 1960, p. 1082-1086.

11174* Aliphatic Chemistry of Fluorene. V. Spiro-Ketones. VI. 3,4-Benzofluorene-9-spiro-cyclohexane. Novel synthesis is described for 1,2;3,4-dibenzophenanthrene, based on the spiro-ketone which was cleaved by strong base to the acid. ***P. M. G. Bavin.*** *Canadian Journal of Chemistry*, v. 38, July 1960, V. p. 1099-1103; VI. 1148-1153.

11175* Macromolecules With High Reactivity Groups. Opinions are expressed concerning the production of macromolecules with diversified groups. Most appropriate in the case are macromolecular substance having functional groups with high reactivity, such as polyaldehydes and polyketones, polyacylhalides and polymer organometallic compounds such as poly-p-lithium styrene, long known but only recently studied. Reactions of these macromolecules and properties of the new polymer substances are described. (*In German.*) Makromoleküle mit Gruppen hoher Reaktivität. ***W. Kern, R. C. Schulz, and D. Braun.*** *Chemiker-Zeitung/Chemische Apparatur*, v. 84, no. 12, June 25, 1960, p. 385-389.

11176 Autoxidation of Organoboron Compounds. The autoxidation of an organoboron compound gives initially an organoperoxyboron compound. From the change in reactivity as the structure of the boron compound is varied, and as other reagents are added, it was suggested that the reaction involves nucleophilic attack of oxygen at the boron atom. ***A. G. Davies, D. G. Hare, and R. F. M. White.*** *Chemistry & Industry*, 1960, no. 20, May 14, p. 556.

11177 The Chemistry of Acrylonitrile. Discusses syntheses, physical properties, chemical properties, polymerization reactions, applications, methods of analysis, and toxicity. 2nd Ed. 272 pp. 1959. American Cyanamid Co., New York. (QD401 Am35c2)

11178* Kinetics of Olefins Hydrocarboxylation. The reaction of cyclohexene hydrocarboxylation by CO and H_2O—studied in the liquid phase under pressure, with acetone as solvent, with $Co_2(CO)_8$ catalyst—is of order ½ with reference to olefin, and of order 1 with reference to H_2O. (*In Italian.*) Cinetica della idrocarbossilazione delle olefine. ***R. Ercoli, G. Signorini, and E. Santambrogio.*** *Chimica e l'Industria*, v. 42, June 1960, p. 587-598.

11179 The Reactions of Trifluoromethyl Radicals With Aromatic Hydrocarbons. I. Benzene, Toluene and o-Xylene. Main reaction with the aromatics is addition of CF_3 to the ring; the expected H abstraction occurs only to a minor extent. Activation energies and pre-exponential factors for both addition

and abstraction reactions were determined. A reason is suggested for the comparative ease of abstraction of H from benzene by CH_3 and CF_3 radicals. ***S. W. Charles and E. Whittle.*** *Faraday Society, Transactions*, v. 56, June 1960, p. 794-801.

11180* The Relationship Between the Catalysed Oxidation of Various Unsaturated Fatty Acids and Environment Factors. The appearance of various types of intermediate and end product of oxidation and free radicals for starting the oxidation reactions are responsible for the different behavior of oxidation of unsaturated fatty acids. Their appearance is in turn dependent upon the type of fatty acids, catalysts, and surrounding factors. The effect of catalysts Cortison, Cu^{++}, and Co^{++} on the autoxidation of various fatty acids were investigated. (*In German.*) Die Abhängigkeit der katalysierten Oxydation verschiedener ungesättigter Fettsäuren von Milieufaktoren. ***W. Schuler, S. Mayor, and R. Meier.*** *Fette, Seifen, Anstrichmittel*, v. 62, no. 5, May 1960, p. 389-394.

11181 Industrial Applications of the Metal Organic Compounds. Industrial applications and future possibilities of the organic compounds of Ni, Co, and other Group VIII metals. ***J. H. Harwood.*** *Industrial Chemist*, v. 36, June 1960, p. 285-290.

11182 Metal Halide Catalyzed Hydrolysis of Trichloromethyl Compounds. Ferric chloride, gallium chloride, and antimony pentachloride catalyze the hydrolysis of carbon tetrachloride to phosgene in high yield under mild conditions. The catalysts are dehydrated by the hydrolysis reaction, affording a convenient means of preparing anhydrous ferric and gallium chlorides. The hydrolysis of other halomethanes, trichloromethylaryl compounds, and trichloroethane is also easily accomplished with ferric chloride catalysis. ***Marion E. Hill.*** *Journal of Organic Chemistry*, v. 25, July 1960, p. 1115-1118.

11183 Synthesis and Hydrolytic Stability of Some Organosilicon Phosphonate Esters. Synthesis by the peroxide-initiated addition of dialkyl phosphonates to substituted vinyl-, allyl-, and cyclohexenylethylsilanes. ***Garrett H. Barnes, Jr. and Mary P. David.*** *Journal of Organic Chemistry*, v. 25, July 1960, p. 1191-1194.

11184 Urea Complexes of Partially Fluorinated Esters. Effect of fluorine on the ability of a partially fluorinated unbranched ester to form a urea channel complex was found to be predominantly steric and not polar. Complex formation depended upon the number of unfluorinated chain atoms referred to as anchor length and upon the location of the anchor in either the alkyl or acyl moieties of the ester. ***Jack Radell and Joseph W. Connolly.*** *Journal of Organic Chemistry*, v. 25, July 1960, p. 1202-1206.

11185* Recovery of Pyridine Bases From Crude Benzole by Ion-Exchange. Efficiency of recovery of the bases attained in the case of benzole, free of forerunnings, is of the order of 98%. The process involves no change in the conventional technique employed for the treatment of crude benzole. ***P. K. Banerjee, S. N. Roy, and A. Lahiri.*** *Journal of Scientific & Industrial Research*, v. 19A, Apr. 1960, p. 174-178.

11186 Organosilicon Compounds. Comprehensive introduction for those contemplating research in organosilicon chemistry or related fields, and as a reference work for those already engaged in such research or involved in industrial applications of organosilicon compounds. Thus, much factual material is presented, experimental methods are emphasized, and references made to a large number of the original publications in the field. ***C. Eaborn.*** 530 pp. 1960. Academic Press, New York. (QD412.S6 Ea15o)

11187* Some Recent Developments in Sesquiterpene Chemistry. ***František Šorm.*** *Record of Chemical Progress*, v. 21, no. 2, June 1960, p. 73-93.

11188* Carbonium-ion Reactions in Allylic Systems. ***Harlan L. Goering.*** *Record of Chemical Progress*, v. 21, no. 2, June 1960, p. 109-127.

11189* Reaction of Polyhalomethanes With Enolethers of Δ^4-3-Ketosteroids. A New Pathway to 6 α-Methylsteroids. ***S. Liisberg, W. O. Godtfredsen, and S. Vangedal.*** *Tetrahedron*, v. 9, nos. 3-4, June 1960, p. 149-155.

11190* Aromatic Polyfluoro-Compounds. V. The Preparation of Highly Fluorinated Benzenes by Defluorination of Polyfluorocyclohex-anes, -enes, and -dienes. Hexa-, penta- and tetra- fluorobenzenes are formed from appropriate polyfluorocyclohexanes, -enes and -dienes by passage in vapor form over heated iron gauze. ***P. L. Coe, C. R. Patrick, and J. C. Tatlow.*** *Tetrahedron*, v. 9, nos. 3-4, June 1960, p. 240-245.

11191* A Biogenetically Patterned Concept for the Laboratory Synthesis of Cyclic Compounds. ***William S. Johnson and Russell A. Bell.*** *Tetrahedron Letters*, 1960, no. 12, June, p. 27-32.

11192* The Role of Iron in Carbonium Ion Reactions of Ferrocene Derivatives. Role of the metal atom with respect to rates and stereochemistry which appear to be of fundamental importance and generality for all metallocene reactions of this type. ***D. S. Trifan and R. Bacskai.*** *Tetrahedron Letters*, 1960, no. 13, June, p. 1-8.

11193* Effect of Solvents Upon the Initial Ozone Attack on Polycyclic Aromatics. Using 9,10-dibromoanthracene as the aromatic species, it was determined that there are two competing types of initial ozone attack and that the one which predominates can be determined by the type of solvent employed. ***Frank Dobinson and Philip S. Bailey.*** *Tetrahedron Letters*, 1960, no. 13, June, p. 14-18.

11194* Ethylene Polymerization as a Organic Half-products Source. Different methods of paraffin and olefin preparation from ethylene in the presence of various catalysts have been discussed. (*In Polish.*) Polimeryzacja etylenu jako źródło półproduktów organicznych. ***Stanisław Malinowski.*** *Wiadomosci Chemiczne*, v. 14, Apr. 1960, p. 199-214.

See also: **11207** (organic oxidation-reduction systems).

CHEMISTRY—PHYSICAL

11195* Photosensitive Complexes of Ferripheophytin With Some Salts. The interaction of ferripheophytin with cyanide, fluoride and thiocyanate salts leads even in the dark to the formation of molecular complexes, the absorption spectra of which differ from that of the initial pigment. The action of visible light on the solutions of these complexes leads in all cases to the formation of a reduced product. (*In Ukrainian.*) Fotochutlyvi kompleksy feofitynu zaliza (III) z deiakymy soliamy. ***M. S. Ashkinazi and A. I. Kriukov.*** *Akademïa Nauk Ukraïns'koï RSR, Dopovidi*, 1960, no. 4, p. 490-493.

11196* Crystalline-Liquid States. I. Phenomena in Melts and in Aqueous Phases. Due to intramolecular forces, double light refraction occurs in some liquids. This suggests a wide arrangement of the liquid molecules in the sense of a uniaxial crystal. These effects were attributed to solvatation, or hydration, cohesion and adhesion forces, in which the spiral space arrangement seems to play an important part. The relationship between anisotropy of the liquid phase, and these forces was studied. (*In German.*) Über kristallin-flüssige Zustände. I. Phänomene in Schmelzen und wässrigen Phasen. ***Konstantin Tomopulos.*** *Chemiker-Zeitung/Chemische Apparatur*, v. 84, no. 11, June 5, 1960, p. 356-362.

11197* Studies of the Chlorination of Mineral Phosphates. Methods for the commercial production of chlorinated inorganic P compounds were described. On the basis of the thermodynamics and kinetics of the chlorination of mineral phosphates, tests of the kinetics of phosphate chlorination, especially of cola phosphate, were conducted. Data were given concerning chlorination reactors, casehardening material, and the calculation of a half technical installation. (*In German.*) Studien zur Chlorierung mineralischer Phosphate. ***J. Liebig, G. Wehner, H. Krausenecker, and K. Schwalm.*** *Chemische Technik*, v. 12, no. 5, May 1960, p. 254-259.

11198* Counter Current Electrical Migration in Molten Halide Mixtures. Test with molten LiBr-KBr mixtures revealed only a partial separation between KBr and LiBr, whereas the separation of the ^{6}Li-^{7}Li isotopes continues up to very high values. Similar results were obtained with LiBr-NaBr mixtures.

It is possible that these phenomena are connected with the existence of balanced ion associations in the molten bath. (*In French.*) Électromigration en contre-courant dans des mélanges d'halogénures fondus. ***Jacques Perie and Marius Chemla.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 250, no. 24, June 13, 1960, p. 3986-3988.

11199 Oxygen Overpotential in Molten Carbonates. Overvoltage of O_2 evolution reaction on Pt electrodes was measured. in a ternary mixture of molten Na_2CO_3-Li_2CO_3-K_2CO_3 with current densities up to 50 ma/cm^2 and temperatures up to 1000 C. ***George J. Janz, Francisco Colom, and Fumihiko Saegusa.*** *Electrochemical Society, Journal*, v. 107, July 1960, p. 581 + 4 pages.

11200 Electrolytic Reduction of Nitro- and Dinitronaphthalenes. Polarographic reduction of mono- and dinitronaphthalenes in buffered solutions at four different *p*H values. Relative wave heights of multiple waves could be reasonably interpreted in terms of certain electron changes, and these were also checked by coulometric measurements on electrolyses run at controlled potentials. ***R. N. Boyd and A. A. Reidlinger.*** *Electrochemical Society, Journal*, v. 107, July 1960, p. 611-615.

11201 Elements of Physical Chemistry. ***Samuel Glasstone and David Lewis.*** 2nd Ed. 758 pp. 1960. D. Van Nostrand Co., Inc., Princeton, N. J. (QD453 G46e2)

11202* Intramolecular Links of Cellulose Nitrate With Different Solvents and Plasticizers. Interactions between cellulose nitrate and acetone, camphor, diethyl phenyl urea were studied in solutions by different optical methods. A hydrogen link was revealed by IR spectra applied to these solutions and to plasticized films or suspension films. (*In French.*) Liaisons intermoléculaires du nitrate de cellulose avec divers solvant et plastifiants. ***Gilbert Chérubin.*** *Journal de Chimie Physique*, v. 57, May 1960, p. 361-373.

11203* The Ionization and the Dissociation of the Molecules by Means of Monoenergetic Electrons. I. Design and Operation of the Ion Source Used. II. Excited States of the Molecular Ion of CO_2 and CS_2. (*In French.*) L'ionisation et la dissociation des molécules par des électrons monoénergétiques. I. Construction et fonctionnement de la source d'ions utilisée. II. États excités de l'ion moléculaire de CO_2 et CS_2. ***Jacques Collin.*** *Journal de Chimie Physique*, v. 57, May 1960, p. 416-429.

11204 The Application of the Effective Atomic Number Rule to Some New Organo-Metallic Complexes. Electronic structures of complexes of the general type $C_nH_nCOFe(CO)_3$ ($n = 2,4,6$) were examined on simple molecular-orbital theory. In the cyclopentadienone and cycloheptatrienone ($n = 4$ and 6) complexes the effective atomic number rule has little significance. It appears that the molecular-orbital point of view provides the most unified picture of the bonding in this series. ***David A. Brown.*** *Journal of Inorganic and Nuclear Chemistry*, v. 13, nos. 3-4, May 1960, p. 212-217.

11205* Synthesis of Methanol on a Zinc-Chromium Catalyst at Reduced Concentrations of Carbon Monoxide in Contact With Gas. If 6% CO is maintained in the circulation gas, the Zn-Cr catalyst works for two and more years with fully satisfactory activity. If 16 to 18% CO is maintained, the catalyst gets out of order after four to six months. Increasing the H_2:CO ratio increases the degree of repression of secondary reactions. An exceptionally high quality of the methanol-raw material guarantees the production of a high quality methanol rectified substance with minimum waste. (*In Russian.*) Sintez metanola na tsinkokhromovom katalizatore pri ponizhennykh kontsentratsiiakh okisi ugleroda v kontaktnom gaze. ***I. A. Makarov.*** *Khimiia i Tekhnologiia, Toplivi* Masel, v. 5, no. 6, June 1960, p. 17-24.

11206* Adsorption Investigations of Silicate Brines on the Surface of Luminescent Substances. Composition and thickness at the surface of microcrystalline ZnS luminescent substances of adsorbed complex layers, when the ZnS microcrystals are suspended in colloidal silica brine coagulated with earth alkali salts, were studied in connection with the composition of the colloidal solution, the grain size distribution of the luminescence crystals, the composition of the bonding agents used, and the material quality of the coagulator. (*In German.*) Adsorptionsuntersuchungen von Silikatsolen an der Oberfläche von Leuchtstoffen. ***I. Hangos, H. Toperzer, Gy. Pozsgay, and L. Vecsernyés.*** *Kolloid-Zeitschrift*, v. 170, no. 2, June 1960, p. 104-112.

11207 Oxidation-Reduction Potentials of Organic Systems. Gives over 100 tables which summarize existing data on groups of organic oxidation-reduction systems in addition to text material on thermodynamics. ***W. Mansfield Clark.*** 587 pp. 1960. The Williams & Wilkins Co., Baltimore. (QD281.09 C54o)

11208* New Absolute Investigations Concerning the Nature of Diluted Solutions of Cellulose Nitrate. After a short description of the coil type of macromolecules, the diffusion theories of visible and X-rays in dissolved coiled molecules, and the determination of the molecule size and weight and of the coiling are discussed. Measurements of light diffusion and of X-ray low-angle diffusion in cellulose nitrate, dissolved in acetone, are described. In the solutions studied, the cellulose nitrate was unbranched and molecularly dispersed. (*In German.*) Neue absolute Untersuchungen zur Natur von verdünnten Lösungen von Cellulosenitrat. ***J. Schurz.*** *Paperi ja Puu*, v. 42, no. 5, 1960, p. 343-349.

11209 Sorption and Diffusion of Simple Paraffins in Silica-Alumina Cracking Catalyst. Measurements were made of methane, ethane, and propane in the silica-alumina cracking catalyst. Sorption data show no evidence of molecular sieve behavior in the micropore structure of the catalyst. The ratio of surface to volume flow increases with increasing molecular weight of hydrocarbons and with decreasing porosity. ***R. M. Barrer and T. Gabor.*** *Royal Society, Proceedings*, v. 256, ser. A, June 21, 1960, p. 267-290.

11210 Thermochemistry of Rhenium Compounds. ***James P. King.*** 96 pp. 1960. Purdue University, Lafayette, Indiana. (QD181.R4 K58t)

11211 The Molecular and Viscous Effusion of Saturated Vapors. This study comprises an investigation of the effusive behavior of saturated vapors over a range of source pressures from 10^{-6} atm in the molecular flow region to 1 atm. Specifically, the purposes of this investigation were to clarify the situation regarding the upper pressure limit to effusive flow, to examine the transition of effusive flow from molecular to viscous behavior, and to clarify some limited aspects concerning the question of vapor saturation within an effusion cell. The effusion rates of mercury flowing through a thin-edged orifice of 0.02-cm radius are predictable by the molecular effusion formula to a pressure of 0.1 mm. Above this pressure, the flow behavior progresses into the hydrodynamical effusion region. At source pressures near 1 atm, the flow rate approaches a limiting value corresponding to the effusion of vapor from a nearly saturated channel. ***K. Douglas Carlson.*** *U. S. Atomic Energy Commission, ANL-6156*, Apr. 1960, 248 pp. (UF767 Un3.1an Contin.)

11212* Physico-Chemical Properties of Chlorine Trifluoride. ClF_3 was obtained by mixing stoichiometric amounts of F and Cl with subsequent heating of the mixture up to 300 C. The melting temperature of ClF_3 of different degrees of purity, the pressure of the vapors from 0 to 1550 mm of the Hg column, the molar thermal capacity, and the viscosity in the liquid state were determined. (*In Russian.*) Fiziko-khimicheskie svoĭstva triftorida khlora. ***Iu. D. Shishkov and A. A. Opalovskiĭ.*** *Uspekhi Khimii*, v. 29, no. 6, June 1960, p. 760-773.

11213* Kinetics of the Thermal Decomposition of Perchlorylfluoride ($FC1O_3$) and the Effects of Foreign Gases on the Reaction. The study was conducted between 5 and 930 mm Hg and 465 and 495 C. The reaction is homogeneous and monomolecular. The constants of the first order depend on the pressure in the case. The average temperature K_∞ is 1.68 and the calculated energy of activation is 58.4 ± 2 kcal. The effects of added silicium tetrafluoride, carbon dioxide, chlorine, O, and A were examined. (*In German.*) Die Kinetik des thermischen Zerfalls von Perchlorylfluorid ($FC1O_3$) und der Einfluss von Fremdgasen auf die Reaktion. ***R. Gatti, J. E. Sicre, and H. J. Schumacher.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 23, nos. 3-4, Feb. 1960, p. 164-189.

COATINGS

11214* Polymerization of Linseed Oil in an Electric Discharge. The treatment of linseed oil by the action of electric discharges in a hydrogen atmosphere ("voltolization") is described. The nature of the polymerization product thus obtained is absolutely different from that of thermally or catalytically polymerized linseed oils. ***C. Boelhouwer, et al.*** *American Oil Chemists' Society, Journal,* v. 37, July 1960, p. 373-376.

11215 Coatings for Non-Structural Surfaces. Discusses coatings for textiles, varnish coatings, rubber coatings, and nitrocellulose coatings. ***William Brushwell.*** *American Paint Journal,* v. 44, July 11, 1960, p. 92 + 6 pages.

11216 Coatings for Non-Structural Surfaces. Nitrocellulose, cellulose, cellulose acetopropionate and other cellulose-based coatings, and vinyl coatings are discussed. ***William Brushwell.*** *American Paint Journal,* v. 44, July 18, 1960, p. 69 + 4 pages.

11217* Manufacture of Hot Dipped Tin Plate. Describes routine control in the manufacture of hot-dipped tinplate. Mentions specialized tests for materials and products. ***O. J. Wiseman and J. Dunning.*** *Australian Institute of Metals, Journal,* v. 5, no. 1, May 1960, p. 45-51.

11218 A Bibliography on Electrical Properties of Porcelain Enamels and Ceramic Coatings. Surveys published literature covering the properties mentioned in the title. Includes articles concerned with similar properties in glasses. ***J. H. Terry.*** *Ceramic Industry,* v. 75, July 1960, p. 44-45.

11219 Comparison of Seven Hot Spray Lacquers. Tests on seven competitive wood lacquers are described. ***Henry G. Knaf.*** *Industrial Finishing,* v. 36, no. 8, June 1960, p. 39 + 3 pages.

11220 Factory Finishing Fine Plywood. A 14-step finishing system, is described. *Industrial Finishing,* v. 36, no. 9, July 1960, p. 76 + 3 pages.

11221* New Galvanising Processes. Further fields for application. *Industrial Finishing (London),* v. 12, June 1960, p. 45-47.

11222 Tensile Properties of Thin, Evaporated Gold Films. The stress-strain curve of the free films on rocksalt was investigated and found to be quite steep up to very high stresses, but plastic deformation and creep were observed even at relatively low stresses. ***C. A. Neugebauer.*** *Journal of Applied Physics,* v. 31, June 1960, p. 1096-1101.

11223* Gas Plating Duplicates Contours Without Machining. Intricate molds, tools, forming dies, patterns, fixtures can now be hard-faced by a vapor-plating technique. Manufacturing time is axed, and the product has valuable and unusual characteristics. *Metalworking Production,* v. 104, no. 26, June 29, 1960, p. 107-108.

11224 Fluidized Bed Coating With Vinyl. Variables in coating thickness and resin fusion. ***R. J. Borsh.*** *Modern Plastics,* v. 37, no. 11, p. 124 + 3 pages.

11225* Correlation of Properties With Structure in Urethane Coating Polymers. A method for the systematic design of urethane coating formulations to give high-quality films has been devised. The investigation was made with an adduct coating based on toluene diisocyanate and castor oil or dehydrated castor oils. This type of coating could be cured through both its diisocyanate and drying oil activity. ***Maurice E. Bailey, Gilbert C. Toone, George S. Wooster, and Edward G. Bobalek.*** *Official Digest,* v. 32, July 1960, p. 984-1001.

11226* The Technical Aspects of Paint Aerosol Loading. A discussion including packaging aspects. ***J. J. McAnally.*** *Official Digest,* v. 32, July 1960, p. 1002-1008.

11227* The Moisture-Resistance of Cold-Cured Epoxide Resin Paints. I. The Influence of Curing Agents. *D. M. James.* *Oil & Colour Chemists' Association, Journal,* v. 43, June 1960, p. 391-408.

11228* Epoxy Resin Varnishes Based on Liquid Epoxy Resins: An Application of Glycidyl Ether Reactivities. *J. Wynstra, R. P. Kurkjy, and N. H. Reinking.* *Oil & Colour Chemists' Association, Journal,* v. 43, June 1960, p. 419-426.

11229* Preparation of Varnish and Varnish Type Vehicles Containing Tung Oil. Data are reported which show that a 100% tung oil varnish formulation can be processed in large volume vessels at the temperatures required for producing non-checking varnish and for the long periods of cooking time inherent in the use of such large volume vessels without danger of gelling. Continuous refluxing of the volatiles was necessary to prevent gelling. ***Paul H. Eaves, J. J. Spadaro, and E. L. Patton.*** *Paint and Varnish Production,* v. 50, no. 8, July 1960, p. 27 + 5 pages.

11230* A Melamine-Acrylic Water Soluble Resin for Industrial Finishes. From data presented it is apparent that the new melamine cross-linked acrylic resin system will have a broad range of utility in industrial and decorative finishing. ***W. H. Hensley and H. J. West.*** *Paint and Varnish Production,* v. 50, no. 8, July 1960, p. 41 + 3 pages.

11231 An Introduction to the Physics of Paint Films. *G. Phillips.* *Paint Technology,* v. 24, June 1960, p. 14-18.

11232 The Rheology of Letterpress and Offset Inks. Flow requirements and transfer properties of inks and the effect of water on the rheology of offset inks. ***E. A. Apps.*** *Research Applied in Industry,* v. 13, June 1960, p. 212-217.

11233 Further Development of Gas-Pressure Bonding of Zircaloy-Clad Flat-Plate Uranium Dioxide Fuel Elements. Techniques were developed for the application of barrier layers of Cr by a vapor-deposition process and of crystalline C by a pyrolytic process. These coatings, together with a graphite coating developed previously, were then evaluated in pressure-bonded fuel elements for their effectiveness in preventing core-to-cladding reaction and for their general production feasibility. Crystalline C coatings 15 to 40 μ in. thick and chromium coatings 25 to 40 μ in. thick were determined to be satisfactory. In the study of the flow of cladding-plate material into void spaces in the picture-frame assembly, it was established that excessive flow, and consequent thinning of the cladding, can be minimized by individually compartmentalizing the cores with Zircaloy ribs. ***Stan J. Paprocki, et al.*** *U. S. Atomic Energy Commission, BMI-*1436, May 11, 1960, 58 pp. (UF767 U3b Contin.)

See also: **11352** (economics of tung oil-resin varnish); **11648** (Pb-Se coating).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

11234* Optimal Dimensions of Operative Memory Units of Electronic Computers. Considers the question of the optimal ratio between the dimensions of an operative ferrite memory unit and those of an external magnetic drum or magnetic tape memory. The criterion for selecting the optimal ratio is the achievement of maximum effective quick response of the computer. The question of the estimate of the magnitude of the round-off error is discussed. (*In Ukrainian.*) Pro optymal'nyyi ob'yem operatyvnykh zapam'iatovuiuchykh prystroyiv elektronnyhh tsyfrovykh mashyn. ***V. M. Glushkov.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi,* 1960, no. 5, p. 571-575.

11235* Obtaining Information Delay in Automatic Systems. In many automatic processes, information obtained in one part of a system must be delayed for a controlled period before it is used by another part of the system. Highlighted in this discussion of a data logging system for a tinplate line is a magnetic drum technique that is both economical and reliable. ***G. E. Terwilliger.*** *Automation,* v. 7, July 1960, p. 68-73.

11236* Roster of Organizations in the Computer Field. *Computers and Automation,* v. 9, June 1960, p. 10 + 35 pages.

11237* Buyers' Guide for the Computer Field: Products and Services for Sale or Rent. *Computers and Automation,* v. 9, June 1960, p. 50 + 23 pages.

11238* Optimization of Business Operations. Discusses mathematical models, accuracy of models, optimization models, and preparation of mathematical models by computer program. ***W. W. Leutert.*** *Computers and Automation,* v. 9, July 1960, p. 5-9.

11239* The Probable Effect of Automatic Computers on the Professions. Discusses economic strength of profession, the professional workers, small computers, organizational use, and information machines for teachers. ***Patrick J. McGovern.*** *Computers and Automation*, v. 9, July 1960, p. 14-16.

11240 A Practical Look at Information Theory. Channel capacity-Nyquist rate, signaling in the presence of noise, a practical coding system, examination of curve, the dependence of procedures on objectives are discussed. ***W. K. MacAdam.*** *Electrical Engineering*, v. 79, July 1960, p. 584-587.

11241* Computers and Control Systems. Outlines two applications of computers to control systems. Considers a computer which derives input instructions for a control system, and describes how computer technique is employed to organize appropriate controls in one system. ***A. Asbury.*** *Institution of Electrical Engineers, Journal*, v. 6, no. 66, June 1960, p. 335-338.

11242* The Statistical Studies on the Response of Automatic Control Systems With a Non-Linear Element of Zero-Memory Type. IV. Presents a theoretical technique for statistical evaluation of the response of servosystems with a non-linear element of zero-memory type subjected to a Gaussian command signal contaminated by a Gaussian noise. Assumes that both the command signal and the random noise have a fairly typical spectrum, which is flat over a certain frequency bandwidth. ***Yoshikazu Sawaragi and Yoshifumi Sunahara.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 64, Dec. 1959, 14 pp.

11243* The Statistical Studies on the Response of Automatic Control Systems With a Non-Linear Element of Zero-Memory Type. V. Some Results on the Synthetical Studies of Control Systems With Random Inputs. In Part V-A, a non-linear control system containing a saturated element subjected to a sinusoidal signal and a Gaussian noise is treated. The influences of non-linearity such as clipping level on the performance of control system are treated in detail for the various values of signal-to-noise ratio of the input to the system. The purpose of Part V-B is to improve the performance of control systems by introducing a non-linear element of zero-memory type, and to evaluate how much better they can be expected to perform than their linear counterparts. ***Yoshikazu Sawaragi and Yoshifumi Sunahara.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 65, Mar. 1960, 17 pp.

11244* Modification of the Equivalent Gains of Non-Linear Elements Considering the Probability Density Function of the Response of Non-Linear Control Systems Subjected to a Gaussian Random Input. Recognizes that the probability distribution function of input signal to the non-linear element in a closed loop control system is not a Gaussian; presents a more precise evaluation of equivalent gain of various non-linear elements in control systems subjected to a Gaussian input. Introduces conception of Markov random process in statistics and considers justification of assumption that response of a non-linear control system is a Gaussian process. ***Yoshikazu Sawaragi and Yoshifumi Sunahara.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 68, Mar. 1960, 16 pp.

11245 Computers in Medical Data Processing. Résumé of the ideas inherent in the utilization of digital electronic computers in medical data processing. Concepts associated with the application of a sequential decision theory applied to the analysis of medical diagnosis, and with the accumulation and recall of individual medical records, are discussed. ***Robert S. Ledley and Lee B. Lusted.*** *Operations Research*, v. 8, no. 3, May-June 1960, p. 299-310.

11246 Servomechanisms With Force Feedback. In a positional servomechanism, positive force feedback has been shown to reduce the effect of load disturbances (both active and passive) on the behavior of the servomechanism. Both analytical (second-order) and experimental results showed that positive acceleration feedback reduces the apparent inertia of the servomotor and thus improves damping and speed of response. Two basic force-reflecting servomechanisms were described and criteria were established by which these mechanisms can be evaluated in terms of their suitability in performing remote manipulations. Methods for improving the characteristics of both systems were analyzed, and negative force feedback was shown to be particularly effective in improving the sense of feel of a force-reflecting remote manipulator. ***Robert C. Arzbaecher.*** *U. S. Atomic Energy Commission, ANL-6157*, May 1960, 119 pp. (UF767 Un3.1an Contin.)

ELECTRICAL ENGINEERING

11247* Metallic Conductors of High Current Density With Cooling According to the "Conductor Substitute" Principle for the Preparation of High Magnetic Fields. For the production of such fields, high current densities are necessary in the exciter conductors. With suitable cooled conductors, these densities are limited upards by the heat transfer number of the conductors relative to their coolant, by the thermomechanical stress and the heat conductivity of the conductor. The current charged conductive material must be replaced at the right time by cold conductive material in the current path of the exciter circuit. (*In German.*) Metallische Leiter hoher Stromdichte mit Kühlung und nach dem "Prinzip des Leiterersatzes" zur Herstellung starker magnetischer Felder. ***Peter Klaudy.*** *Acta Physica Austriaca*, v. 13, nos. 2-3, May 1960, p. 274-292.

11248 Annual Report 1959. Conference on Electrical Insulation, Division of Engineering and Industrial Research. 153 pp. 1960. National Academy of Sciences—National Research Council, Washington, D. C. (TK3401 N21a Vis.)

11249* Circuit-Breaking Tests in the Systems of Western Europe. The annual report for 1958-1959 of the U.C.P.T.E. contains statements on circuit-breaking tests in which five countries took part. A condensed report is given on these tests and on the results achieved. The measurements cleared up some questions related to generator utilization, system loading and efficiency and regulation. (*In German.*) Abschaltversuche in den Netzen Westeuropas. ***Konrad Meyer.*** *ETZ: Elektrotechnische Zeitschrift*, v. 12, Ausgabe B, no. 12, June 1960, p. 297-299.

11250* A New Method of Determining the Daily Load Curve. A new method is described for the recording of the electric power, in which the revolutions of the discs in the electricity meter are scanned photoelectrically and are converted to set a potentiometer, the position of which, at the end of a period of constant times of rotation, gives a measure of the mean power. These measurements are transmitted every four minutes to the device which records and reproduces the curves, and this therefore produces a stepped curve. (*In German.*) Neues Verfahren zum Ermitteln der Tagesbelastungskurve. ***Helmut Laakmann.*** *ETZ: Elektrotechnische Zeitschrift*, v. 12, Ausgabe B, no. 13, June 1960, p. 317-319.

11251 Instrumentation for Exploding Wire Research. Electrical explosion of 1-mil wire yields high current density, pressure and temperature; Kerr cell camera photographs exploding aluminum wire are discussed. ***Norman Chase, Norbert Hankin, and Francis Webb.*** *Electronics*, v. 33, no. 27, July 1, 1960, p. 43-45.

11252* The Limit Span of Transmission Lines. The solution of some problems that arose during the elaboration of the standard for power transmission lines (MSz 151) and its appendix. In connection with a numerical example it gives the solution of the transparent equations for calculating the limit span, this solution being adopted for use in technical practice. (*In Hungarian.*) A határoszlopköz. ***Rezső Sztanó.*** *Elektrotechnika*, v. 53, no. 4, 1960, p. 173-180.

11253* Graphic Means for the Evaluation of the Dynamic Stability in Electric Compound Networks. Graphic representations of the load state and reactances of the network, of the momentum force of the parallel working power plants, and certain auxiliary calculations helped to determine the dynamic stability of interconnecting mains in case of a multiplicity of heavy disturbances, in a simple mathematical way. (*In German.*) Anschauliche Hilfsmittel zur Beurteilung der dynamischen Stabilität elektrischer Verbundnetze. ***A. Kaminski.*** *Energietechnik*, v. 10, no. 5, May 1960, p. 204-208.

11254* Gaseous Discharge Phenomena in High-Voltage D.C. Cable Dielectrics. Considerations of the short-time electric strength and of the conductivity/temperature/stress relationships show that both impregnated paper and polythene are likely to be satisfactory dielectrics for use in h.v.-d.c. cables. Polythene was selected as the example for study, on account of its known vulnerability to discharges, and it is shown that, with this material, discharge damage is unlikely to be a serious problem under d.c. conditions. ***E. C. Rogers and D. J. Skipper.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. A, no. 33, June 1960, p. 241-254.

11255* The Characteristics and Protection of Semiconductor Rectifiers. Describes probable sphere of application of monocrystalline semiconductor rectifiers and states the problems which must be solved to ensure reliable operation under both normal and abnormal conditions. Discusses properties of h.r.c. fuses. Concludes with a description of the practical application of these special fuses. ***D. B. Corbyn and N. L. Potter.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. A, no. 33, June 1960, p. 255-272.

11256* The Application of Linear Induction Motors to Conveyors. Principal advantage in using linear induction motors to drive conveyor belts is that force can be applied uniformly to the belt over a wide area without mechanical contact. Main problem in designing a linear motor for such a drive arises from the fact that the speeds required are low, and it is shown that efficient systems are possible only if the motor is supplied with low-frequency power. ***E. R. Laithwaite, D. Tipping, and D. E. Hesmondhalgh.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. A, no. 33, June 1960, p. 284-294.

11257* Concerning the Power Factor of an Autodyne. The power factor of an ideal autodyne is equal to the ratio of the rectified voltage on the wipers and its highest value. In nonreversible circuits, that is where no changes of polarity are needed, the autodyne can work as a receiver with leading cos ϕ, giving an important reactive current in the network. In reversible circuits in a non-symmetrical reversible cycle, the resulting cos ϕ of the autodyne is also a leading one. (*In Russian.*) O koeffitsiente moshchnosti avtodina. ***L. S. Pisarik.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Energetika,* 1960, no. 4, Apr., p. 34-39.

11258 Theory of Superconducting Contacts. The BCS theory of superconductivity is generalized to the case of a position-dependent energy gap (at the absolute zero of temperature and in the absence of magnetic fields). The BCS integral equation for the energy gap goes over into an integrodifferential equation. The latter has nontrivial solutions (i.e., finite energy gap) even for the case of normal material (V=O). Expressions are obtained for the energy gap, for the volume energy density, and for the surface energy density at an interface, for both normal and superconducting material. These results are applied to a number of problems involving superconducting contacts. ***R. H. Parmenter.*** *Physical Review,* v. 118, 2nd ser., no. 5, June 1, 1960, p. 1173-1182.

11259* The Statistical Distribution of the Depth of the Fading Processes in the Intervals of Radio Relay Systems. Expressions were found for the interval curves of this type of distribution under normal assessment of the values of the effective vertical gradient of the specific inductive air capacitance and also specific expressions for the curves of distribution. (*In Russian.*) O statisticheskom raspredelenii glubiny zamiranii na intervalakh radioreleinykh linĭ. ***A. I. Kalinin.*** *Radiotekhnika,* v. 15, no. 6, June 1960, p. 3-9.

11260* Using the Variable Reactive Load Method for Measuring Dielectric Properties of Materials. A method of measurement, based on the application of variable reactive load, was developed for the determination of dielectric parameters of nonferromagnetic materials with high and medium losses. Necessary calculated ratios are cited and nomograms are drawn by the aid of which the dielectric parameters E′ and E″ can be found in accordance with experimental results. (*In Russian.*) Primenenie metoda peremennoĭ reaktivnoĭ nagruzki dlia izmereniia dielektricheskikh svoĭstv materialov. ***V. I. Aksenov.*** *Radiotekhnika i Elektronika,* v. 5, no. 5, May 1960, p. 771-781.

11261 Transformers and Generators for Power Systems. Their Behaviour, Capabilities and Rating. Steady-state electromagnetic theory, various arrangements of winding design, and their relation to the parameters of the transformer, the insulation of transformers, losses, temperature rise and cooling, abnormal conditions, voltage regulation with transformers and autotransformers, phase connection, some special types of construction, guide for the specification engineer and other problem are discussed. ***R. Langlois-Berthelot.*** 541 pp. 1960. Philosophical Library, New York. (TK2551 L26t)

11262 Thermoelectric Generators. The basic phenomenon, materials and their parameters, devices and design, projected applications are discussed. ***Stephen J. Angello.*** *Westinghouse Engineer,* v. 20, no. 4, July 1960, p. 99-101.

11263 Thermionic Generators. The principle of operation is discussed. A small thermionic generator using Cs vapor is described. ***John Coltman.*** *Wetinghouse Engineer,* v. 20, no. 4, July 1960, p. 102-104.

11264 Magnetohydrodynamic Generators. The MHD is described; MHD generator cycles, research in MHD and the future of MHD are discussed. ***Stewart Way.*** *Westinghouse Engineer,* v. 20, no. 4, July 1960, p. 105-107.

See also: **11265** (Ge rectifier); **11452** (electric space propulsion); **11469** (space power sources); **11770** (design of electrical networks).

ELECTROCHEMISTRY

11265* The Germanium Rectifier for Electrolysis and Plating Baths. The efficiency and price of Ge rectifiers are between 30 V and 80 V more favorable than for Se and Si rectifiers. The cooling of the Ge rectifier under the climatic conditions in Central Europe generally makes possible full utilization of the elements. The elements are protected by special fuses. Components in the installation which can be used for controlling the d.c. voltage are adjustable transformers with C contacts, selsyn-type regulators, and d.c. pre-magnetized chokes; their circuits and modus operandi are explained. The regulation of Ge rectifier installations concludes the article. (*In German.*) Der Germanium-Gleichrichter für Elektrolysen und galvanische Bäder. ***Horst Völger.*** *ETZ: Elektrotechnische Zeitschrift,* v. 12, Ausgabe B, no. 12, June 1960, p. 285-291.

11266 A Study of the Oxidation of Hydrogen at Platinized Platinum Electrodes. A coulometric technique using a polarograph was used to study the oxidation of H at platinized Pt electrodes. The results obtained by this technique are in agreement with resutls obtained by charging curve and a-c bridge techniques. This technique showed the presence of two forms of H adsorbed at the surface of the Pt, and it also showed the presence of H absorbed in the Pt. ***Thomas C. Franklin and Samuel L. Cooke, Jr.*** *Electrochemical Society, Journal,* v. 107, June 1960, p. 556-560.

11267* Thickness and Hardness Measurements on Gold Deposits. The main object on thickness measurement is to keep the metal surface as nearly optically flat as possible and avoid rounding of the edges. If measurements of hardness are made on the surface, the use of the diamond pyramid is preferable because it may give a better average reading on a group of columnar crystals usually oriented perpendicular to the surface. The Knoop indentor, being of rhomboid design and very elongated, is chosen primarily for cross section measurements, where lack of sufficient thickness does not allow the use of the diamond pyramid. ***Grace A. Wilson.*** *Metal Finishing,* v. 58, June 1960, p. 50-52.

11268* Ultrasonics in Zinc Electroplating. Effect on Elastic Properties of Steel. Alkaline cleaning in hot solutions containing 100 g./l. NaOH results in some loss of elastic properties of steel with a hardness of Rockwell C50. The use of ultrasonics in cleaning at first results in a sharp loss of elastic properties, then the elastic properties of steel return to their original values. ***Larissa Domnikov.*** *Metal Finishing,* v. 58, June 1960, p. 59-61.

11269* Automatic *p*H Regulation of Nickel-Plating Solutions. The effect of variations of the *p*H value in nickel-plating baths are described. Presents the fundamentals of automatic *p*H

regulation and practical points of view for the equipment. ***Gunnar Gabrielson.*** *Metal Finishing Journal*, v. 6, no. 66, June 1960, p. 239-242.

11270* Velocity of Exchange Between Cobalt and Its Ions in Solution. This velocity is very low. In aqueous solutions of cobalt chloride the current of exchange is $4.5 \cdot 10^{-6}$ a/cm^2. The existence of a parallelism between the velocity of exchange of the metals with ions in solution and the velocity of the electroreduction of the ions at the cathode was confirmed. (*In Russian.*) Skorost' obmena mezhdu kobal'tom i ego ionami v rastvore. ***Z. A. Solov'eva, L. A. Uvarov, and A. T. Vagramian.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 6, June 1960, p. 1185-1188.

See also: **11110** (improved fluorine cell); **11563** (adherence of Cr plate).

ELECTRONICS

11271* Electron Transition by Means of Light Absorption and Emission in Electron Donator/Acceptor Complexes. The energy transfer in the course of ion formation by means of direct electron transition from an organic electron donator molecule D to an organic electron acceptor molecule A being taken as a basis, intermolecular bonding by means of intramolecular mesomerism in electron donator/acceptor complexes (EDA-complexes) is explained. Then the electron absorption spectra and the emission (fluorescence and phosphorescence) spectra of electron donator/acceptor complexes are discussed. (*In German.*) Elektronenüberfuhrung durch Lichtabsorpton und -emisison in Elektronen-Donator-Acceptor-Komplexen. ***G. Briegleb and J. Czekalla.*** *Angewandte Chemie*, v. 72, no. 12, June 21, 1960, p. 401-413.

11272* Survey of the Nonlinear Distortions in Transistor Stages, and of the Cross Modulations. A nonlinear transfer characteristic is approached by the first terms of a Taylor expansion and the distorted output voltage is calculated for a suitably chosen input voltage. This general derivation is specialized for the skewed transistor exponential function $I_B = f(\mathrm{UEB})$ and the equations for several distorted output voltages are stated. Describes two possibilities to reduce cross modulation in a transistorized RF amplifier. (*In German.*) Übersicht über die nichtlinearen Verzerrungen in Transistorstufen, einschliesslich der Kreuzmodulation. ***Helmut Lotsch.*** *Archiv der Elektrischen Übertragung*, v. 14, May 1960, p. 204-216.

11273* The Frequency Response of Magnetic Recorders for Audio. The total frequency response of a magnetic tape recorder depends on the amplifier responses, the heads, and the tape. Response standards have been established by NAB and CCIR for the reproduce chain, using an "ideal" reproduce head and a prescribed post-emphasis. Techniques are discussed and data shown for calibrating the reproduce chain. ***John G. McKnight.*** *Audio Engineering Society, Journal*, v. 8, no. 3, July 1960, p. 146-153.

11274* A Signal Biasing Output Transformerless Transistor Power Amplifier. A practical output transformerless transistorized amplifier was developed which achives excellent quality at a minimal cost. By utilizing the energy storage capability of a loudspeaker, the amplifier exhibits the control of a Class A amplifier with operational efficiencies approaching Class B. ***Richard C. Heyser.*** *Audio Engineering Society, Journal*, v. 8, no. 3, July 1960, p. 185-192.

11275* Optimum Process in Second-Order Pulse-Relay System. The problem of finding optimum control law in the second-order pulse-relay system is treated. (*In Russian.*) Optimal'nyĭ protsess v releĭno-impul'snoĭ sisteme vtorogo poriadka. ***V. N. Novoseltsev.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 569-574.

11276* On Circuits of Correctors of Binary Signals. Describes the methods of designing and correcting signal systems elaborated by M. A. Gavrilov, R. R. Varshamov, and R. W. Hamming. Structural formulae of corrector circuits are found for each of the correction methods described. The corrector circuits are designed. (*In Russian.*) O skhemakh korrektorov binarnykh signalov. ***V. M. Ostianu.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 615-623.

11277* 10-Channel Automatic Electronic-Relay Optimizer. Describes operational part of amplifiers, regulating part includes relays and step locators. Gives example of solving a problem with the optimizer. (*In Russian.*) 10-Kanal'nyĭ avtomaticheskiĭ elektronno-releĭnyĭ optimizator. ***A. B. Shubin.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 624-632.

11278* Reliability Characteristics of Resistances and Capacitors. Considers methods of presenting reliability characteristics for resistances and capacitors versus temperature of environment and dissipated power or applied voltage. (*In Russian.*) Kharakteristiki nadezhnosti sóprotivleniĭ i kondensatorov. ***B. S. Sotskov and S. E. Rostkovskaya.*** *Avtomatika i Telemekhanika*, v. 21, no. 5, May 1960, p. 633-638.

11279 Basic Electronics. ***J. Daly and R. A. Greenfield.*** 226 pp. 1959. Heywood & Co., Ltd., London. (TK7815 D17b)

11280* The Impulse Transformer for the Production of High-Voltage Pulses. By means of impulse transformers, in which capacitor discharges flow through the primary winding, high-pulse voltages and powers can be generated for any desired pulse recurrence frequency. Describes an example of an installation for individual pulses, the maximum voltage being 500 kV and permissible capacitance 500 pF; the maxium power is 180 MW. (*In German.*) Stosstransformator zur Erzeugung von Hochspannungsimpulsen. ***Frank Früngel.*** *ETZ: Elektrotechnische Zeitschrift*, v. 81, Ausgabe A, no. 10, May 9, 1960, p. 355-360.

11281 A Telemetering System for Stomach Pressure of Animals. A telemetering system for veterinary research dealing with stomach pressure of ruminant animals is described. The system, consisting of a transmitter, receiver, and recorder, has worked satisfactorily with an animal in a 4-acre enclosure. ***R. W. Allington.*** *Electrical Engineering*, v. 79, July 1960, p. 590-593.

11282* Semiconductor Devices, Present and Future. Names the varactor diode, the Esaki or tunnel diode and the controlled rectifier as outstanding devices. Mentions the solid-state circuitry and hopes that in five or more years semiconductor devices will be full circuits. ***Harper Q. North.*** *Electromechanical Design*, v. 4, no. 7, July 1960, p. 37-40.

11283* The Role of Space Charge Waves in Modern Microwave Devices. I. Deals with the fundamental characteristics of space charge wave propagation and shows how the waves can be considered in terms of a transmission line analogy. ***G. D. Sims and I. M. Stephenson.*** *Electronic Engineering*, v. 32, July 1960, p. 408-412.

11284* A Graphical Analysis of the Blocking Oscillator. III. An attempt has been made to give a complete graphical analysis of the operation of the blocking oscillator and to describe a practical procedure for determining component design-center values. Special purpose valves, with controlled emission and positive grid characteristics are becoming available. ***D. Chambers.*** *Electronic Engineering*, v. 32, July 1960, p. 430-434.

11285 Tunnel Diode Logic Circuits. Three important facets of tunnel diode logic circuits are examined: diode current-voltage characteristics, modes of operation and effect of circuit component tolerances. Derived tolerance equations serve as valuable design tools. ***W. F. Chow.*** *Electronics*, v. 33, no. 26, June 24, 1960, p. 103-107.

11286 Sea-Going Lightning Generator. Schoonerborne million-volt artificial lightning generator with a 10,000 foot helicopter-supported antenna is being used to produce high-power low-frequency radiated pulses similar to lightning atmospherics. These pulses provide for studying low-frequency propagation over long distances with possible practical applications in the fields of long-range communication and navigation. At present the technique is primarily a research tool for vlf propagation studies; it permits better ionospheric measurements and studies of whistlers, normally associated with lightning strokes, by producing artificial sferics at specific locations. A long high antenna is required to simulate lightning discharges since such dis-

charges may progress for several miles before ending at ground or in other clouds. The one million volt generator is capable of producing a peak power of about 30 Mw with a 3,000 meter antenna. This power could be increased to about 100 Mw by increasing the generator voltage. At the peak voltage of one million volts, the calculated field strength of a 20 Kc pulse at a receiver 1,000 km distant would be about 20 mv per meter. Even at 10,000 km (6,200 miles) the signal strength is about 100 microvolts per meter. ***M. M. Newman, J. R. Stahmann, J. D. Robb, and E. A. Lewis.*** *Electronics*, v. 33, no. 30, July 22, 1960, p. 53-55.

11287 The Preceptron—An Experiment in Learning. The perceptron is a minimally restrained artificial nerve network consisting of logically simplified neural elements, or signal generating units, and the connections between them. This synthetic network has been shown capable of learning to discriminate and recognize perceptual patterns and is expected to provide data on the performance of actual physical systems for comparative study. Elementary perceptrons used to simulate the biological network are organized so that sensory units (S-units) are threshold devices used to translate a stimulus into a discrete set of electrical signals. The sensory device is 20 x 20 square matrix of photoresistive cells mounted in a phenolic base plate. Photocell currents actuate transistor-driven relays which supply the excitatory and inhibitory (plus and minus) S-unit output signals. Each photocell which receives sufficient light supplies both signal polarities to a patchboard. Since 20 A-unit connections are made available for each signal from an S-unit, and since there are 400 S-units with bipolar outputs, the patchboard has 400 x 200 x 2 or 16,000 available output connections. The perceptron is shown the letter D while simultaneously it is told the identifying response by forcing the response to the correct values and reinforcing them. Then the perceptron is shown another letter, or perhaps the same letter in a different position. Each time the correct response is forced. After a number of forced learning trials, the perceptron is tested by presenting the letters and asking it to identify them. ***William E. Bushor.*** *Electronics*, v. 33, no. 30, July 22, 1960, p. 56-59.

11288* Tunnel Diodes. This new semiconductor device resembles other diodes in that it consists simply of a p-n junction. The barrier or space-charge layer is extremely thin, about 10^{-6} cm, and is formed between two very heavily doped regions. This combination of thin barrier and heavy doping results in the unique tunnel-diode characteristic. For all values of reverse voltage the tunnel diode is highly conductive. For a small forward bias, the current increases with voltage, peaks at 50 mV, drops to a minimum in the next 200 mV (giving a negative-resistance region) and then increases exponentially with higher forward voltages. Tunnel diodes can have a frequency response in the kMc/s region, tolerate larger doses of nuclear radiation, do not require elaborate surface cleaning and final sealing techniques, have a wide-temperature operating range, require low d-c power levels measured in microwatts, appear advantageous as low-noise devices, and are easy to manufacture. In contrast to the desirable features of tunnel diodes, they are two-terminal devices; present techniques do not permit design of a multistage amplifier; they have no third terminal which could be used for triggering purposes; and have a maximum power output level of the order of 1 mW. There are indications that tunnel diodes will eventually find many applications in the microwave field. The top frequency will be limited by technical fabrication difficulties such as the maximum doping possible or the minimum mounting impedance. Oscillations have been observed with a fundamental as high as 1.4 Gc/s^5 and 3 Gc/s^6. Some other applications under investigation are in information storage and logic functions; low-level r.f. detection, and r.f. voltmeter rectifier. ***G. N. Roberts.*** *Electronic Technology*, v. 37, June 1960, p. 217-222.

11289 Electron Tube Life Factors. Discusses characteristics, properties, and ratings; design and control of tests; analysis and presentation of data; interpretation and application of the data; heater-voltage test; bulb-temperature test; heater-cycling test; plate dissipation, plate voltage, plate-current test; mechanical-excitation test; pulse-operation test; and computer pulse operation. General conclusions are cited. ***Craig Walsh and T. C. Tsao, editors.*** 173 pp. 1959. Engineering Publishers, Elizabeth, N .J. (TK7872.V3 M17e)

11290* The Recording Density of the Electric Pulses on a Ferromagnetic Carrier. The density of information recording depends closely on the magnetizing ampere-turn of the head. Their increase lowers the density. The recording intensity of the pulse depends closely on the squareness $\beta = \frac{H_m}{H_c}$ of the hysteresis loop of the magnetic material. Increasing β causes a reduction of the sloping parts in the curve of the intensity of magnetization of the carrier and an increase in the density. (*In Russian.*) O plotnosti zapisi elektricheskikh impul'sov na ferromagnitnom nositele. ***V. G. Makurochkin.*** *Elektrosviaz'*, v. 14, no. 6, June 1960, p. 33-38.

11291* The "Persistor"—A Superconducting Memory Element. The basic components of a Persistor memory element are a superconducting inductor in parallel with a switch element which is normally superconducting, but which becomes resistive when the current exceeds a critical value. When a suitable current pulse is applied to a Persistor memory element, a persistent circulating current is stored. ***E. C. Crittenden, Jr., J. N. Cooper, and F. W. Schmidlin.*** *I.R.E. Proceedings*, v. 48, July 1960, p. 1233-1246.

11292* A New Class of Switching Devices and Logic Elements. With a new class of switching devices employing microwave tube elements, appropriate combinations of particular components can create a variety of devices that are capable of performing switching and logic at extremely high speeds. A preliminary device described herein demonstrated the ability of a microwave signal to control a dc current. ***P. R. McIsaac and I. Itzkan.*** *I.R.E. Proceedings*, v. 48, July 1960, p. 1264-1271.

11293* Skin Effect in Semiconductors. Deals with the theory of skin effect in semiconductor materials including the effect of displacement currents, which are generally neglected in the skin-effect theory for metallic conductors. In the case of flat plates, formulas are derived for the field distribution, the impedance and the eddy-current power losses, considering symmetrical electric as well as magnetic fields. ***A. H. Frei and M. J. O. Strutt.*** *I.R.E. Proceedings*, v. 48, July 1960, p. 1272-1277.

11294* Excitation of Piezoelectric Plates by Use of a Parallel Field With Particular Reference to Thickness Modes of Quartz. The parallel field excitation of piezoelectric plates, particularly of plates vibrating in thickness modes, and their resulting piezoelectric stress constants in general and of various quartz cuts are considered. Quartz AT-cut crystals excited by a parallel field are of practical interest for high precision frequency control. ***R. Bechmann.*** *I.R.E. Proceedings*, v. 48, July 1960, p. 1278-1280.

11295* Transient Behavior of Aperture Antennas. For an antenna which is illuminated by a field of uniform phase and either uniform or cosine tapered amplitude, it is shown that the steady-state main lobe is established within $(\tau/2 + R/c)$ seconds after the aperture is energized. τ is the period of the carrier frequency, R is the distance from the center of the aperture to the point where the field is evaluated, and c is the velocity of light. ***Charles Polk.*** *I.R.E. Proceedings*, v. 48, July 1960, p. 1281-1288.

11296 Electronic-Type Resistor Reliability Measurements Study. Results of the preliminary investigation show the temperature coeffiicent index and the short-time overload test to be the more promising of the nondestructive tests. However, there was some association noted for the short-time humidity test with moisture resistance. ***B. F. Lathan, H. G. Hamre, and R. M. Bergslien.*** *IRE Transactions on Instrumentation*, v. 1-9, no. 1, June 1960, p. 4-12. (TK In6.6i Vis.)

11297 Endoradiosondes: Further Notes. A supplement to last year's summary on swallowable radio transmitters. Included are general comments on procedure as well as specific items such as temperature sensitivity, the use of tunnel diodes in pH measurement, the use of multiple transmitters, and the design of a nondirectional receiving antenna system. ***R. Stuart Mackay.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 2, Apr. 1960, p. 67-73. (TK1 In6.6m Vis.)

11298 Microphony in Waveguide. Describes the mechanism of phase modulation by waveguide in the presence of a high intensity acoustic field. X-band rectangular was studied to

determine the following: resonant frequency in a transverse vibrational mode, and means of minimizing phase modulation. ***I. Goldstein and S. Soorsoorian.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 3, May 1960, p. 372-375. (TK1 In6.6mt Vis.)

11299* Some Recent Developments in Transistors and Related Devices. Utilization of an avalanche-multiplication mechanism, avoided in conventional transistor operation, enables ultra-high-speed switching to be achieved, with rise-times of only one or two millimicrosec. A recent semiconductor-device development is the four-layer triode, or Si controlled rectifier, which has important power control applications. ***A. R. Boothroyd.*** *Institution of Electrical Engineers, Journal*, v. 6, no. 66, June 1960, p. 342-347.

11300* Effect of Field of Force in Germanium p-n Junctions. The results of measuring inverse currents in commercial diodes on the pulse voltage are examined. In electric fields of force ($E \sim 10^5$ *v/cm*) there was an increase of the inverse current due to the Ziner effect. The effects of the pulse duration on the inverse branch of the volt ampere characteristic in low electric fields and in fields of force were detected. (*In Russian.*) Effekt sil'nogo polia v germanievykh p-n perekhodakh. ***V. I. Gaman, V. A. Perkal'skii, G. V. Kallestinov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika*, 1960, no. 2, p. 3-9.

11301* I. Magnetoelectric and Thermomagnetoelectric Effects in Semi-Conductors. The electrical conductivity of a crystal in the presence of a magnetic field is investigated by the method of the average energy gain. It has been possible to express the current density in tensor form, as a function of the electric and magnetic fields, in the case of a single valley. (*In French.*) I. Effets magnétoélectriques et thermomagnétoélectriques dans les semi-conducteurs. ***L. Godefroy and J. Tavernier.*** *Journal de Physique et le Radium*, v. 21, no. 4, Apr. 1960, p. 249-260.

11302* Improvements in a C.W. Power Travelling-Wave Tube. Describes a number of improvements in a "clover leaf" c.w. travelling-wave amplifier for X-band. The alterations, which include the introduction of a new electron gun, re-designed waveguide transitions and a light-weight electromagnet, have converted an experimental tube into a practical c.w. transmitter. ***M. O. Bryant, J. F. Gittins, and F. Wray.*** *Journal of Electronics and Control*, v. 7, no. 6, Dec. 1959, p. 505-517.

11303* Breakdown and Light Emission in Gallium Phosphide Diodes. Gallium phosphide diodes can show avalanche breakdown when biased in their reverse direction, and the phenomena associated with this breakdown are entirely similar to those found in Si diodes. Possibility of using such diodes as sources of very fast light pulses, as has already been demontrated with Si. ***J. W. Allen and P. E. Gibbons.*** *Journal of Electronics and Control*, v. 7, no. 6, Dec. 1959, p. 518-522.

11304* Turn-on Transient of p-n-p-n Triode. The turn-on transient of the p-n-p-n switch is analysed with simplifying assumptions. Experiments on the Si p-n-p-n power triode show that the two mechanisms determine the current waveform during the transient. Before the center junction becomes forward biased, the current increases nearly exponentially. After switch-on, the p-n-p-n switch behaves as an inductive impedance and the increase rate of current decreases. ***Toshio Misawa.*** *Journal of Electronics and Control*, v. 7, no. 6, Dec. 1959, p. 523-533.

11305 High Frequency Light Modulation. High-frequency light modulation has been realized using a magnetically driven rotor suspended by a magnetic field in a vacuum chamber. With a rotor 1 in. in diameter having 180 reflecting faces, modulation frequencies in the megacycle region are readily obtainable. Gives design considerations for the rotor described. ***R. L. Williams.*** *Journal of Scientific Instruments*, v. 37, June 1960, p. 205-208.

11306* Investigation of the Stability of the Steady Conditions of a Generator With a Circuit Between the Anode and the Grid, by the Energetic Method. The parameters of the equivalent network of a generator, valid for the transition conditions were obtained. The effects of the parameters of the generator on the stability of the steady conditions in the case of a soft oscillatory characteristic of the anodic and cathodic currents were examined. The form of this characteristic of the cathodic current definitely influences the stability of the steady conditions and the process of amplitude and frequency. (*In Russian.*) Issledovanie ustoĭchivosti statsionarnykh rezhimov generatora s konturom mezhdu anodom i setkoĭ energeticheskim metodom. ***E. P. Korchagina.*** *Nauchnye Doklady Vysshei Shkoly, Radiotekhnika i Electronika*, 1959, no. 2, p. 176-184.

11307* Thermoelectron Properties of Titanium, Zirconium, Hafnium and Thorium Oxides. These oxides were tested as possible materials for thermionic cathodes. Hafnium oxide gives a lower emission than Th oxide, yet differs by a better fission of the sintering layer with a W core. Cathodes based on oxides of ZrO_2 and especially TiO_2, give a low emission and a poor sintering capacity with the core. (*In Russian.*) Termoelektronnye svoĭstva okislov titana tsirkoniia, gafniia i toriia. ***B. V. Bondarenko.*** *Nauchnye Doklady Vysshei Shkoly, Radiotekhnika i Elektronika*, 1959, no. 2, p. 330-335.

11308* Structure of the Active Layer on Grids With an Oxide Cathode. With the layer model proposed (similar to that of Rittner for the usual oxide cathode), it is possible to explain all the experimental results and to determine the direction of work in making high-temperature (600 - 800 C) protective grid layers. (*In Russian.*) Struktura aktivnogo sloia na setkakh s osidnym katodom. ***M. D. Malev.*** *Nauchnye Doklady Vysshei Shkoly, Radiotekhnika i Elektronika*, 1959, no. 2, p. 350-362.

11309 Determination of Numbers of Injected Holes and Electrons in Semiconductors. In semiconductors, deviations Δ_n and Δ_p of the equilibrium numbers n_0 and p_0 of electrons and holes are unequal in many cases because of trapping. It is shown how measurements of the photo Hall-effect and photoconduction may give information on the numbers Δ_n and Δ_p separately. From the ratio Y of the relative change of the Hall-effect and of the photoconductivity, the quantity $K = \Delta n / \Delta p$ can be evaluated. ***F. van der Maesen.*** *Philips Research Reports*, v. 15, no. 2, Apr. 1960, p. 107-119.

11310 Grown *P-N* Junctions in Silicon Carbide. An account is given of the preparation and properties of grown junctions in SiC. The forward characteristics are tentatively explained on the basis of a *p-i-n*-structure. *P-n* luminescence has been observed containing violet light. ***C. A. A. J. Greebe and W. F. Knippenberg.*** *Philips Research Reports*, v. 15, no. 2, Apr. 1960, p. 120-123.

11311 Small-Signal Performance and Noise Properties of Microwave Triodes. The conclusions are: (1) The electronic admittances of the triode can be calculated with reasonable accuracy on the basis of the single-velocity transit-time theory provided that the current density is so high that the distance from cathode to potential minimum is small compared to the cathode-grid distance; (2) The noise properties of the triode are only slightly affected by total-emission noise, transit-time spread and feed-back. The random emission from the cathode is the most important noise source. ***M. T. Vlaardingerbroek.*** *Philips Research Reports*, v. 15, no. 2, Apr. 1960, p. 124-221.

11312 Photo-Electronic Image Devices. Proceedings of a Symposium Held at London, September 3-5, 1958. Discusses photo electronic imaging devices for astronomical observations, astronomical tests of barrier-membrane image convertors, image intensifier developments in the RCA electron tube division, field emission in image tubes, amplification of transient images in high-gain photocathode-phosphor image-intensifier systems, the tri-alkali stabilized C.P.S. emitron: a new television camera tube of high sensitivity, and other problems. ***J. D. McGee and W. L. Wilcock, editors.*** v. 12. 397 pp. 1960. Academic Press, Inc., New York. (TK161 A95e Vis.)

11313 Crystal Potential and Energy Bands of Semiconductors. III. Self-Consistent Calculations for Silicon. An approximately self-consistent crystal potential is constructed for Si from a superposition of free-atom core and a sampling of crystal valence band charge densities. Valence-core exchange is calculated directly from core wave functions while valence-valence exchange is included using momentum-independent and momentum-dependent approximations taken from the results for a free-electron gas. The resulting crystal potential is surprisingly similar to one previously obtained by Woodruff from a super-position of free-atom charge densities. ***Leonard Kleinman and James C. Phillips.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1153-1167.

11314 Effect of High Pressure on Some Hot Electron Phenomena in *n*-Type Germanium. The pressure dependence of the current density vs. electric field characteristic for *n*-type Ge at 297 K has been measured to a maximum pressure of 30,000 kg/cm^2, and to a maximum field of 10,000 v/cm. It is concluded that the electrons are "heated" by the field sufficiently to cause the conduction band valleys along the $<100>$ directions in reduced momentum space to be appreciably populated with electrons at atmospheric pressure. ***Seymour H. Koenig, Marshall I. Nathan, William Paul, and Arthur C. Smith.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1217-1221.

11315 Internal Field Emission at Narrow *p-n* Junctions in Indium Antimonide. Experimental study was made of the field and temperature dependence of internal field emission in narrow *p-n* junctions in indium antimonide. Relatively good agreement, both qualitative and quantitative, is obtained between experimental results and usual expression for barrier transparency. ***A. G. Chynoweth and R. A. Logan.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1470-1473.

11316 Properties of Elemental and Compound Semiconductors. Metallurgical Society Conferences. *Harry C. Gatos, editor.* v. 5, 340 pp. 1960. Interscience Publishers, New York. (QC612.S4 Am35.7p)

11317 Quantum Electronics—A Symposium. Molecular beam masers, a low temperature atomic beam oscillator, maser research in Japan, use of parallel plate resonators, use of some new molecules in a beam type maser, the feasibility of building beam type masers, molecular beam formation by long parallel tubes, focusing molecular beams of NH_3, optical pumping and related effects and other problems are discussed. ***Charles H. Townes, editor.*** 606 pp. 1960. Columbia University Press, New York. (QC447 C76q)

11318* Space Pattern and Radiation Polarization of Symmetrical Reflector Antenna. The space pattern and the radiation polarization of the symmetrical reflector antenna, caused by a combination of electric and magnetic dipoles, are calculated. Shows that for the radiation near the antenna axis, the cross polarization diagram equals with the half of the difference of the diagram in E and H planes. The part of energy used in cross-polarization radiation is calculated. (*In Russian.*) Prostranstvennaia struktura diagrammy i poljarizatsiia izlucheniia osesimmetrichnykh zerkal'nykh antenn. ***B. E. Kinber.*** *Radiotekhnika i Electronika*, v. 5, no. 5, May 1960, p. 720-726.

11319* Waveguide Bend of Variable Curvature. In waveguides of many waves the bend is the source of considerable losses on the conversion into undesired types of waves. The problem of reduction of these losses is solved by the way of creation of a bend, the curvature of which changes according to a fixed law along its length. A rational form of the curvature was found, which guarantees the least amplitudes of parasitic waves in the maximum belt of frequencies at a given length of the curvature. (*In Russian.*) Volnovodnyĭ izgib peremennoĭ krivizny. ***N. P. Kerzhentseva.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 733-739.

11320* Experimental Investigation of Electromagnetic Wave Scattering on Periodical Irregular Surfaces. Results of experimental investigations of electromagnetic 7.95 mm wave scattering on metallic and semiconducting surfaces of sinusoidal and saw-shaped profiles are cited. The obtained results are compared with results of calculations, which were completed on the basis of the theory of scattering, developed by L. M. Brekhovskikh, In. P. Lysanov, and W. Meecham. (*In Russian.*) Eksperimental'noe issledovanie rasseianiia elektromagnitnykh voln na periodicheski nerovnykh poverkhnostiakh. ***V. I. Aksenov.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 782-795.

11321* Measurement of Transistor Conductance in the Microwave Region. Describes the noncontact method of measurement of the electroconductivity of transistors, in particular of Ge and Si. The method can be used with success on rating of the purity of Si after chemical purification. The material must be needle shaped. The measurement is carried out by the determination of the quality of a tubular resonator without the sample and afterwards with the sample. (*In Russian.*) Izmerenie provodimosti poluprovodmikov v diapazone santimetrovykh voln. ***V. Gusa and B. Kvasil.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 796-805.

11322* On the Problem of Inverse Collector Current in a Function Transistor. The possibility and some advantages of the calculation of the regime and temperature stabilization of the operation point on transistor cascades by the value ICOE of the inverse collector current on a disconnected basis are shown. (*In Russian.*) K voprosu ob obratnom toke kollektora v ploskostnom tranzistore. ***P. A. Popov.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 806-810.

11323* On One Method of Raising Transistor Resonance Stability. Based on the correction of internal reverse coupling of triodes. (*In Russian.*) Ob odnom metode povysheniia ustoĭchivosti rezonansnykh usiliteleĭ na poliprovodnikovykh triodakh. ***Yu. L. Simonov.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 811-817.

11324* Maximum Parameters of Wide Band-Pass Amplifiers. Ratios are calculated and diagrams cited, which determine the maximum number of cascades in the amplifier and the maximum band-pass at the required value of the total amplifying coefficient. (*In Russian.*) Maksimal'no dostizhimye parametry polosovykh shirokopolosnykh usiliteleĭ. ***B. N. Krutov.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 818-826.

11325* Ribbon-Shaped Electron Beam in a Periodic Magnetic Field in Case of Arbitrary Shielding of a Cathode. It is possible to obtain in a plane two-dimensional periodic magnetic field a stable ribbon-shaped electron beam with a weak waviness of the beam contour. (*In Russian.*) Lentochnyĭ elektronnyĭ puchok v periodicheskom magnitnom pole pri proizvol'noĭ stepeni ekranirovke katoda. ***I. V. Aliamovskii.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 827-833.

11326* Electron Contact Tubes. Discusses the operating principle of contact tubes with the use of secondary emission, and which are foreseen as rapidly-operating contact elements in a series of outfits in automatics, telemechanics, computing and measuring technics. Some types of monocontact and multiple-contact tubes are described and their basic parameters cited. (*In Russian.*) Elektronnye kontaktnye lampy. ***E. V. Bykhovskaya, A. M. Kharchenko, M. I. Elinson, and D. V. Zernov.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 849-857.

11327* Fundamental Circuits With Transistors. Owing to various specific transistor characteristics, considerable advantages can be derived from their application in control-system networks. In this contribution a survey is given of the possible uses of transistors by discussing some essential networks, e.g. signal choppers, constant phase amplifiers, power amplifiers, pulse and numerical circuits. (*In German.*) Grundsätzliche Schaltungen mit Transistoren. ***A. Haidekker.*** *Regelungstechnik*, v. 8, no. 5, 1960, p. 154-157.

11328 Selected Semiconductor Circuits Handbook. Direct-coupled amplifiers, low-frequency amplifiers, high-frequency amplifiers, oscillators, switching circuits, logic circuits, A-C to D-C power supplies, power converters, small-signal nonlinear circuits, magnetic and transistor circuits are discussed. ***Seymour Schwartz, editor.*** Individually paged. 1960. John Wiley & Sons, New York. (TK7872.S4 Sch96s)

11329 Semiconductors. *R. A. Smith.* 494 pp. 1959. Cambridge University Press, New York. (QC612.S4 Sm64s)

11330 A Vertical Aperture Equalizer for Television. A vertical aperture equalizer employing delays of one scanning line has been built and has been used on commercial broadcasts to increase the subjective sharpness of television pictures. By using both vertical and horizontal aperture equalization, optical aperture defects can be corrected. ***W. G. Gibson and A. C. Schroeder.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, June 1960, p. 395-401.

11331 Solid State Physics in Electronics and Telecommunications. Semiconductors. Discusses preparations of semiconductors and applied problems, properties of semiconductors, solid-state theory, effects of intense electric fields in semiconductors, noise in semiconductors, surface phenomena. ***M. Désirant and J. L. Michiels, editors.*** v. I. 638 pp. 1960. Academic Press, New York. (TK7872.S4 So44)

11332* Relation of Turbulence Theory to Ionospheric Forward Scatter Propagation Experiments. This paper attempts to relate turbulence theories to radio measurements on

vhf ionospheric forward scatter circuits. To this end, the single scattering description of the electromagnetic response of electron density irregularities and the corresponding transmission expression are evaluated. Statistical distributions of signal levels are found to agree with a scattering model. ***Albert D. Wheelon.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 64D, no. 4, July-Aug. 1960, p. 301-309.

11333* Diffraction by Smooth Conical Obstacles. Expressions obtained earlier [1,2]3 for the calculation of diffraction due to conducting obstacles with smooth cylindrical surfaces, are generalized to oblique incidence and to surfaces of conical shape. The derivation is based on a generalized concept of the Green's function and on the use of corrective factors that take the same place as corrections introduced by other authors into the theory of diffraction by apertures. ***H. E. J. Neugebauer and M. P. Bachynski.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 64D, no. 4, July-Aug. 1960, p. 317-329.

11334* C Band Tunable Magnetron. Design, construction, operating characteristics, circuits and testing were described. (*In French and English.*) Magnétron accordable dans la bande C. ***M. Paliès.*** *Vide*, v. 15, no. 86, Mar.-Apr. 1960, p. 140-150.

11335* Theory of the Radar Reflections From the Ground Surface. The value of the radar signal, reflected by rough surfaces, can be calculated by the disturbance method. With the result obtained, the effects of the surface structure, its complex dielectric permeability, the angle of incidence and polarization of the incident wave can be evaluated. Surfaces covered by low vegetation in the form of thin cylinders with losses were studied. (*In Russian.*) Teoriia radiolokatsionnykh otrazheniĭ ot zemnoĭ poverkhnosti. ***Piik.*** *Zarubezhnaia Radioelektronika*, 1960, no. 3, Mar., p. 3-15.

11336* Quadrupolar Amplifier, a Parametric Instrument With a Low Noise Level. A new type of amplifier with an electronic bunch permits the recording of a very low noise level and a high and stable amplification in a rather wide frequency band. Explains the principle of operation of this amplifier based on the action of the transverse field of a quadrupolar condenser on a rapid cyclotron wave. (*In Russian.*) Kvadrupol'nyĭ usilitel' - parametricheskiĭ pribor s nizkim urovnem shumov. ***Adler, Grbek, and Veid.*** *Zarubezhnaia Radioelektronika*, 1960, no. 3, Mar., p. 110-128.

11337* Slowing-Down Time of Nonequilibrium Current Carriers in Semiconductors. Slowing-down times are derived for electrons and holes which are not in thermal equilibrium with the semiconductor lattice. It is shown that account of degeneracy does not appreciably affect the slowing-down time. (*In Russian.*) Vremena zamedleniia neravnovesnykh nositeleĭ toka v poluprovodnikakh. ***O. N. Krokhin and Yu. M. Popov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1589-1592.

11338* The Preparation of Titanium Dioxide Semiconductor on Titanium at Low Oxygen Pressures. Metallic Ti has been oxidized at low O pressures over the temperature-range 650-1100 C. The low O pressures were obtained by heating titanium dioxide powder. As a result of the oxidation a titanium dioxide layer was formed on the Ti. At temperatures ranging from 650-850° the layer was defective titanium dioxide of the structure of rutile. (*In Russian.*) Poluchenie poluprovodnikovoĭ dvuokisi titana na titane pri malykh davleniiakh kisloroda. ***V. A. Dorin, D. N. Nasledov, and F. M. Tartakovskaia.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 4, Apr. 1960, p. 809-814.

See also: **11444** (motion picture film for TV); **11659** (Si semiconductors); **11814** (thermoelectric materials).

ENGINEERING ECONOMICS

11339* A Small Company Wants to Grow One Size Larger. Concerns a New England bakery firm which should initiate better utilization of its production facilities, and formulate long-range objectives. ***J. Hugh Funk and Fremont A. Shull, Jr.*** *Business Horizons*, v. 3, no. 2, Summer 1960, p. 52-64.

11340 Corporate Diagrams & Administrative Personnel of the Chemical Industry. ***Kenneth R. Kern, editor.*** 82 pp. 1960. Chemical Economic Services, Princeton, N. J. (TP130 C42c Over.)

11341 The Great Growth Debate. What is the best method of planning for economic growth in this country—a "forced" growth by government planning or a "natural" growth of a free economy? ***William H. Peterson.*** *Dun's Review and Modern Industry*, v. 76, no. 1, July 1960, p. 34-36.

11342 Economic Survey of Europe in 1959. Individually paged. 1960. Secretariat of the Economic Commission for Europe, Geneva. (HC240 Un2.2e Vis.)

11343 The Logistics of Distribution. The choice of distribution system each company makes will have a significant impact on product design, plant investment, and organization. ***John F. Magee.*** *Harvard Business Review*, v. 38, no. 4, July-Aug. 1960, p. 89-101.

11344 Multi-Stage Approach to Pricing. The outlined pricing policy demands a long-range view of price by emphasizing the enduring effect of most price actions on company and brand image. It allows the price decision to be made in stages. ***Alfred R. Oxenfeldt.*** *Harvard Business Review*, v. 38, no. 4, July-Aug. 1960, p. 125-133.

11345 Mineral Resources and Metal Reserves. Discusses problems of raw materials for the metal industry, development of the mining industry, proportionate uses of metals, the economics of supply, distribution of mineral resources. ***Ronald L. Prain.*** *Institute of Metals, Journal*, v. 88, pt. 9, May 1960, p. 387-393.

11346 The Italian Iron and Steel Industry in the Post-War Period, and Its Future Prospects. Since 1945 the Italian iron and steel industry has been reorganized and developed so that by 1957 Italy had become 7th largest steel producer in the world. Considers the main post-war problems of materials, finance, and organization, and outlines the solutions reached. Probable future lines of development of the industry are also considered. *Iron and Steel Institute, Journal*, v. 195, pt. 1, May 1960, p. 16-25.

11347* Changing Patterns of Land Values. Recent dynamic factors in land values, due chiefly to new transportation media, have caused profound changes in the old land value patterns and changed calculations based on the continuation of former trends. ***Homer Hoyt.*** *Land Economics*, v. 36, no. 2, May 1960, p. 109-117.

11348* Toward a Water Resource Development Program for Eastern Rivers. Water-related interests in the East, water programs in eastern states, industrial and municipal water, government for water, and the federally created basin agency are discussed. ***Guthrie S. Birkhead and Jesse Burkhead.*** *Land Economics*, v. 36, no. 2, May 1960, p. 142-157.

11349 The New Product. How to Find, Test, Develop Cost, Price, Protect, Advertise and Sell New Products. Basic concepts, organizing for product development, finding new product ideas, costing and pricing the new product, patents, research and engineering, market research, sales, advertising, management considerations of new product development are discussed. ***Delmar W. Karger.*** 234 pp. 1960. Industrial Press, New York. (HD69.N4 K41n)

11350 Midyear Report. Drilling shows a gain, completions a decline, domestic demand a gain, crude oil a decline, refinery runs a decline, crude and product imports a decline, production of natural-gas liquids an increase. Gas pipelines will have one of their biggest construction years. *Oil and Gas Journal*, v. 58, no. 30, July 25, 1960, p. 143-174.

11351* Aluminum in the Sixties. Despite present problems of oversupply, Alcoa's president sees promising prospects for Al in the decade ahead. Bullish factors include population growth, low per capita use of aluminum overseas, opening of new markets. ***F. L. Magee.*** *Modern Metals*, v. 16, no. 5, June 1960, p. 68 + 1 page.

11352* Tung Oil—Resin Varnish Vehicle. Tung oil-resin varnish vehicle is produced from tung oil and resin by a process, developed by the Southern Utilization Research and Development Division, which prevents gelation. Investment costs, operating costs, general expenses, and a cost analysis are given for producing the 50% solids mixture during 10% of the operations of the hypothetical plants. ***K. M. Decossas, P. H. Eaves, S. P. Koltun, and E. F. Pollard.*** *Paint and Varnish Production*, v. 50, no. 8, July 1960, p. 33 + 4 pages.

11353 Profit Pattern Analysis and the Industrial Engineer. ***Marshall K. Evans.*** *West Virginia University, Technical Bulletin No.* 58, Apr. 1960, p. 14-22. (TA21 W52t Contin.)

11354 Simulation Applied to Manufacturing. Stresses the importance of using simulation so that the consequences of change in policies, conditions, or methods can be predicted without running the risk of actually attempting the change in the shop. ***H. Ford Dickie and Elton C. Throndsen.*** *West Virginia University, Technical Bulletin No.* 58, Apr. 1960, p. 36-41. (TA21 W52t Contin.)

11355 Maintenance and Profits. The real objective should always be to attain that level of maintenance which will produce the lowest possible product costs. Gives examples in charts of how well planned maintenance can be effective. ***Earl L. Petersen.*** *West Virginia University, Technical Bulletin No.* 58, Apr. 1960, p. 51-61. (TA21 W52t Contin.)

See also: **11435** (exploratory drilling costs for U); **11460** (economics of conventional and nuclear power); **11472** (economics of larger turbine generator units); **11774** (direct iron economics).

FLUID MECHANICS

11356 Heat or Mass Transfer in a Fluid in Laminar Flow in a Circular or Flat Conduit. Accurate solutions to the Graetz equation and to the similar equation for flow between two parallel plates are presented. ***George Martin Brown.*** *A.I.Ch.E. Journal*, v. 6, no. 2, June 1960, p. 179-183.

11357 The Thermal Entrance Region in Fully Developed Turbulent Flow. Velocity profile and the pressure were also measured at selected points. ***Peter H. Abbrecht and Stuart W. Churchill.*** *A.I.Ch.E. Journal*, v. 6, no. 2, June 1960, p. 268-273.

11358* Design of Gasified Liquid Flows With a Two-Parameter Characteristic of Permeabilities. The possibility of applying two-parameter functions to the formation of liquids was examined. The use of one-parameter functions for permeabilities causes increase of the flow in the first period and a decrease of the exploitation time. (*In Russian.*) O raschetakh techeniĭ gazirovannoĭ zhidkosti pri dvuparametricheskoĭ khrakteristike pronitsaemosteĭ. ***D. A. Efros and I. F. Kuranov.*** *Akademiia Nauk SSSR, Doklady*, v. 132, no. 3, May 21, 1960, p. 553-556.

11359* Dynamics of a Fluid Interface. Equation of motion for Newtonian surface fluids. ***L. E. Scriven.*** *Chemical Engineering Science*, v. 12, no. 2, May 1960, p. 98-108.

11360* Two-Phase (Gas-Liquid) Flow Phenomena. I. Pressure drop and hold-up for two-phase flow in vertical tubes. ***G. H. Anderson and B. G. Mantzouranis.*** *Chemical Engineering Science*, v. 12, no. 2, May 1960, p. 109-126.

11361* Heat Transfer to Non-Newtonian Fluids Under Laminar-Flow Conditions. Rates of heat transfer to non-Newtonian fluid systems passing through smooth round tubes under laminar flow conditions have been studied both experimentally and theoretically, for the case in which viscous heat generation may be neglected. Comparative data have been correlated with an average deviation of 16%. ***A. B. Metzner and D. F. Gluck.*** *Chemical Engineering Science*, v. 12, no. 3, June 1960, p. 185-190.

11362* Transfer From a Sphere Into a Fluid in Laminar Flow. ***M. Linton and K. L. Sutherland.*** *Chemical Engineering Science*, v. 12, no. 3, June 1960, p. 214-229.

11363 Some Correlations Between Thermodynamic Properties and the Structure of Liquids. A set of standard molecular liquids is selected whose thermodynamic properties conform to certain simple equations and with which the properties of other liquids can be compared. The method involves a modification of Trouton's rule, similar to Hildebrand's well-known variant. ***D. H. Everett.*** *Chemical Society, Journal*, 1960, June, p. 2566-2573.

11364* Calculation of the Laminar and Turbulent Pressure Drop at a Pipe Inlet. Easily manipulated formulae are derived for laminar and turbulent pipe inlet flow which are in good agreement with more rigid theories and results of measurements. The laminar-turbulent transition and jet contraction in the pipe inlet are treated and formulae are also presented. (*In German.*) Berechnung des laminaren und turbulenten Druckabfalles im Rohreinlauf. ***N. Scholz.*** *Chemie-Ingenieur-Technik*, v. 32, June 1960, p. 404-409.

11365* Fluid-in-Fluid Dispersions. Physicochemical Principles and Uses in Chemical Engineering. Types of dispersions are characterized: bulk transport, sedimentation, diffusion; for that purpose, the dispersion is in some cases regarded as an equivalent continuous fluid; in others, one considers the movements of each globule, assuming it is individual. Deals also with the procedure of mass, heat, or electrical transfer between the continuous phase and the dispersed one. (*In French.*) Les dispersions fluide-dans-fluide. Principes physico-chimiques et utilisations en Génie chimique. ***Pierre Le Goff.*** *Chimie & Industrie (Génie Chimique)*, v. 83, no. 6, June 1960, p. 170-182.

11366 Hydromagnetic Channel Flows. ***Lawson P. Harris.*** 90 pp. 1960. John Wiley & Sons, New York. (QC809.M3 H24h)

11367* Thermal Diffusion in Liquids. Prior to the engineering investigation of thermal diffusion, this phenomenon was studied in the ordinary horizontal cells from a phenomenological standpoint, in which the pure Soret effect could be observed. A method of instantaneous determination of Soret coefficient and ordinary diffusion coefficient in a simpler way and in shorter time is proposed. Test results obtained from the Tanner type cell, and Korsching's, are compared. ***Tokuro Mizushina, Satoru Iuchi, Ryuzo Ito, and Osamu Yoshikawa.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 66, Mar. 1960, 9 pp.

11368 Non-Newtonian Fluids. Fluid Mechanics, Mixing and Heat Transfer. Classification, experimental characterization, and flow of non-Newtonian fluids in pipes and channels; their heat transfer characteristics; viscometric measurements and apparatus. ***W. L. Wilkinson.*** v. I. 138 pp. 1960. Pergamon Press, New York. (TP156.F6 W65n)

11369 Resistance in Pipelines of Hydraulic Transport Installations. Present analytic methods are not reliable. Formulae suggested by various research workers disclose serious discrepancies. Recommends individual formulae for each class, i.e., concentration and grading of pulp. (*In Czech.*) Poznámky k teorii odporů hydrosměsi v potrubí. ***J. Novák.*** *Strojírenství*, v. 10, no. 5, May 1960, p. 345-348.

11370* About Stationary Flow of the Conducting Liquid Through an Endless Circular Tube in the Radial Magnetic Field Presence. (*In Russian.*) Nekotorye voprosy statsionarnogo techeniia provodiashcheĭ zhidkosti v beskonechno dlinnoĭ kol'tsevoĭ trube pri nalichnii radial'nogo magnitnogo polia. ***I. B. Chekmarev.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 30, no. 6, June 1960, p. 601-605.

See also: **11105** (rheology in cosmetics); **11109** (viscosity unit conversion); **11124** (pipeline hydraulic transport resistance); **11798** (flow of a non-Newtonian liquid over a rotating disk).

FOOD TECHNOLOGY

11371 The Chemistry and Technology of Cereals as Food and Feed. ***Samuel A. Matz, editor.*** 732 pp. 1959. The AVI Publishing Company, Inc., Westport, Conn. (TS2145 M43c)

11372* **Lysine Fortification of Food.** Enrichment of cereals with amino acids, particularly lysine, has been proposed as a partial solution to the problem of protein deficiency among underfed peoples. This report surveys present knowledge, discusses some experiments in amino acid supplementation, and concludes that the costly process of enriching deficient diets may well be less economic than increasing the supply of protein-rich foods. ***A. E. Bender.*** *Food Manufacture*, v. 35, July 1960, p. 280-284.

11373* **World Food Supplies. VI. World Requirements. I.** ***Francis Aylward.*** *Food Manufacture*, v. 35, July 1960, p. 288-292.

11374* **Swift Tenderizes Beef on the Hoof.** The method of tenderizing calls for the injection of about a cupful of the enzyme papain into the circulatory system of cattle approximately ten minutes before slaughter. Tenderizing action, however, is not started until the enzyme is activated by the heat of cooking. All of the meat of the animal is affected. ***Joe Voorhees.*** *Food Processing*, v. 21, July 1960, p. 40 + 1 page.

11375* **Quantitative Aspects of Lysine Deficiency and Amino Acid Imbalance.** An imbalance can be created through the addition of an essential amino acid mixture deficient in one amino acid (lysine) which was also limiting in the dietary protein. The imbalance is due to an altered ratio of the limiting amino acid to the total available protein or essential amino acids. ***H. Fisher, P. Griminger, G. A. Leveille, and R. Shapiro.*** *Journal of Nutrition*, v. 71, no. 3, July 1960, p. 213-220.

11376* **Amino Acid Requirements of Men and Women. II. Relation of Lysine Requirement to Sex, Body Size, Basal Caloric Expenditure and Creatinine Excretion.** Requirements of men varied from 400 to 1200 mg, and of women from 300 to 700 mg per day. The mean lysine requirement of 10 men was 750 mg and of 10 women 550 mg. These mean values are useful in estimating needs of population groups, but not of individuals. ***Helen E. Clark, S. P. Yang, Wanda Walton, and Edwin T. Mertz.*** *Journal of Nutrition*, v. 71, no. 3, July 1960, p. 229-234.

11377 **Review of Grass Juice Investigations.** Fresh forages and concentrated forage juice contain important labile unidentified growth factors which are largely destroyed by conventional dehydration and by haymaking. ***G. O. Kohler.*** *U. S. Agricultural Research Service, ARS-74-15*, July 1960, unpaged. (S584 Un3.1ar Contin.)

FUELS AND COMBUSTION

11378 **Burning Rates of Solid Propellants.** A model is proposed which takes into account heat transfer, diffusion, and chemical reaction processes. ***J. M. Smith.*** *A.I.Ch.E. Journal*, v. 6, no. 2, June 1960, p. 299-304.

11379* **On the Burning of a Smoke-Gas Mixture of Powder.** The relations of the absorption capacity of a smoke-gas mixture as a function of the height of the torch flame at 20 and 40 atm and other pressures were studied. When the mixture is formed during the dispersion of the reaction layer of the powder, the high concentration of smoke is equal to about 1.1 g/cm³, and at a distance of 0.25 mm at 20 atm pressure it becomes equal to 30 mg/cm³. Obviously the basic mass of the smoke particles breaks down near the surface of the powder. (*In Russian.*) O sgoranii dymogazovoĭ smesi porokha. ***V. M. Mal'tsev and P. F. Pokhil.*** *Akademiia Nauk SSSR, Doklady*, v. 132, no. 3, May 21, 1960, p. 646-648.

11380* **The Problem of Pyrite and Sulphonic Groups in the Process of Spontaneous Combustion of Coals.** Coals not spontaneously combustible and not containing Fe and S may be transformed into violent self-ignition, when sulfonic sulfur has been introduced into them by means of the sulfonation reaction. The reconstruction of the sulfonic groups was obtained by diluted solutions of nitric acid. The formation of the sulfuric acid causes the sulfonation of coals, making them more or less inclined to spontaneous combustion. (*In Polish.*) Zagadnienie pirytu i ugrupowań sulfonowych w procesie samozapalenia węgli kamiennych. ***Zbigniew Było.*** *Archiwum Górnictwa*, v. 5, no. 1, 1960, p. 99-115.

11381 **The Mechanism of Coal Hydrogenation.** Gasification of coals in H at higher temperatures (900 C) and pressures of about 50 atm appears practicable. The mechanism of Li reduction is different from that of hydrogenation. The latter occurs at the softening point of the coal where the mechanisms of depolymerization and carbonization can be interfered with, and where the temperature may be critical. ***F. J. Pinchin.*** *British Coal Utilisation Research Association, Monthly Bulletin*, v. 23, Dec. 1959, p. 465-476.

11382* **Solid Propellant Mixtures for Rockets.** Gives general data characterizing the principal raw materials, the transformation they must undergo, their mixing, and their loading in the interior of the rocket. (*In French.*) Quelques aspects de la fabrication des mélanges propulseurs solides pour fusées. ***B. H. Sanders.*** *Chimie & Industrie*, v. 83, no. 6, June 1960, p. 859-867.

11383 **The Mining Guidebook.** Guidebook to new developments in coal mining industry; includes buying directory. *Coal Age*, v. 65, July 1960, 244 pp.

11384* **The Kinetics of Carbon Gasification. II.** The reaction of C with H and the role of the water-gas shift reaction in gasification. ***J. D. Blackwood.*** *Coke and Gas*, v. 22, June 1960, p. 250 + 4 pages.

11385* **The Combustion of Several Commercial Gases.** Composition of commercial fuels, their variations, and corresponding combustion diagrams are given. The values obtained concerning air and smoke volumes are related to the thermal capacities and compared with previous data. Factors which mask control of combustion in smoke analysis are given. The perturbations in the combustion process, caused by variations in the thermal capacity of a gas, are explained. (*In Spanish.*) Sobre la combustion de varios gases industriales. ***Angel Sanchis Cueto.*** *Combustibles*, v. 19, nos. 105-106, Sept.-Dec. 1959, p. 165-176.

11386* **Burning Rates and Ignition Temperatures of Hydrogen Peroxide Solutions.** Mass burning rates were found to agree closely with the flame velocities as measured for the vapor by the Bunsen burner method, when compared at equal adiabatic decomposition temperatures. ***C. N. Satterfield, E. Kehat, and Maria A. T. Mendes.*** *Combustion and Flame*, v. 4, no. 2, June 1960, p. 99-105.

11387* **Studies of Combustion Processes Leading to Ignition in Hydrocarbons.** ***K. C. Salooja.*** *Combustion and Flame*, v. 4, no. 2, June 1960, p. 117-136.

11388* **The Passage of Explosions Through Narrow Cylindrical Channels.** Shows that a propagating methane-air flame does not travel through channels of less than about 3 mm diameter, although ignition may still occur in the outer chamber. ***H. G. Wolfhard and A. E. Bruszak.*** *Combustion and Flame*, v. 4, no. 2, June 1960, p. 149-159.

11389 **The Inhibition of the Hydrogen–Oxygen Reaction by Methane.** ***R. R. Baldwin, N. S. Corney, and R. W. Walker.*** *Faraday Society, Transactions*, v. 56, June 1960, p. 802-814.

11390* **Recent Developments in the Hasche Process.** Peak shaving is facilitated by development of automatic equipment for production of a low specific gravity, high Btu gas from distillates in the gasoline boiling range. ***Richard P. Clarke.*** *Gas Age*, v. 125, June 23, 1960, p. 31-32.

11391* **In-Line Blending of Fuel Oils.** Various types of pumps, a Fisher blending unit, and a Smiths in-line viscosity controller are described, and the versatility and advantage of in-line blending of oil is discussed. *Gas and Oil Power*, v. 55, no. 665, June 1960, p. 142-144.

11392* **Petrol Injection: Some Further Developments.** Recent developments of a shuttle metering injection system, and details of the construction and operation of high-speed six- and eight-cylinder units are described. ***E. W. Downing.*** *Institution of Mechanical Engineers, Automobile Division, Proceedings*, 1957-1958, no. 6, p. 161-173.

11393* **Coking Processes in the Petroleum Industry.** The importance of employing processing techniques in petroleum refineries for producing more of the middle distillates and less

of the lighter fractions from indigenous petroleum crudes has been emphasized. The scope and application of "delayed coking" and "fluidized coking" processes have been examined. ***V. P. Gupta, I. B. Gulati, and A. N. Basu.*** *Journal of Scientific & Industrial Research*, v. 19A, Apr. 1960, p. 168-174.

11394 Stable Combustion of a High-Velocity Gas in a Heated Boundary Layer. Concludes that a continuous ignition mechanism governs stabilization in heated turbulent boundary layers. Transition from the low-speed mechanism known to be applicable in unheated turbulent boundary layers and heated laminar boundary layers to the ignition mechanism applicable in heated turbulent boundary layers is explained. ***Donald L. Turcotte.*** *Journal of the Aero/Space Sciences*, v. 27, July 1960, p. 509-516.

11395 A Study of Supersonic Combustion. Steady, stable, plain, and oblique detonation waves were created in a high-temperature, steady-flow supersonic tunnel. Ignition conditions and properties across the wave were measured. The local-wave fluid-dynamic properties agree well with detonation theory. ***Robert A. Gross and Wallace Chinitz.*** *Journal of the Aero/Space Sciences*, v. 27, July 1960, p. 517-524.

11396 Colloids May Cut Space Travel Time. A relatively unexplored concept, the electrical acceleration of colloidal particles, gives promise of bridging the gap between the chemical and other varities of electrical propulsion. ***Milton Farber and Stanley Singer.*** *Missiles and Rockets*, v. 7, no. 2, July 11, 1960, p. 25-26.

11397* Evaluation and Exploitation of Black Coal Seams. Coking coke semiproducts over 30 mm in grain size are advantageously reduced into three products. A maximum 30 mm size gives a 11 to 30 mm final semiproduct suitable for gasification. 80 mm semiproducts are advantageously reduced into two products. The maximum size will be 30 mm, eventually 10 mm. (*In Czech.*) Hodnocení a úprava proplástku černého uhli. ***O. Radek.*** *Paliva*, v. 40, no. 5, May 1960, p. 156-159.

11398* The Fundamental Mechanism of Carbon Combustion. Tests revealed that the mechanism of combustion of C is basically identical in O_2, H_2O, and CO_2, although the speed of reaction differs widely according to the type of oxidizing gas. The maximum speed of reaction is between 1400 and 1650 K. Complex phenomena are explained by competition between the creation of active C atoms during the etching of the crystal lattice by the gaseous reagent and by a spontaneous reorganization of this lattice. (*In French.*) Le mécanisme fondamental de combustion du carbone. ***Maurice Letort.*** *Revue Universelle des Mines*, v. 16, ser. 9, June 1960, p. 255-271.

11399 Leonardite: A Lignite Byproduct. Leonardite is a coal-like substance, similar in structure and composition to lignitic coal and believed to be derived from lignitic coal by the process of natural oxidation. The higher O content and less compact structure of leonardite make it undesirable as a fuel, but indicate that it has potential as a source of chemicals. It is a convenient source of humic acids. ***Walter W. Fowkes and Clyde M. Frost.*** *U. S. Bureau of Mines Report of Investigations* 5611, 1960, 12 pp. (TN21 Un3r Room 290)

11400* The Influence of Hydrogen or Deuterium on the Flame-Propagation Velocity of Carbon Monoxide and Air Mixtures. Velocity of mixtures consisting of air and pure CO does not depend on the concentration of the latter. By adding small quantities of H or deuterium, the square of the flame-propagation velocity increases proportionally to the amount of agents added. (*In German.*) Die Beeinflussung der Zündgeschwindigkeit von Kohlenoxyd-Luft-Gemischen durch Wasserstoff oder Deuterium. ***Theo Scholte.*** *VDI Zeitschrift*, v. 102, no. 17, June 11, 1960, p. 673-677.

See also: **11112** (natural gas substitutes from petroleum); **11113** (pipeline gas by methanation of synthesis gas); **11420** (Athabascar oil sands); **11465** (combustion in a quartz piston engine); **11773** (coal industry).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

11401 Speed of Sound in Sea Water as a Function of Temperature, Pressure, and Salinity. Tables were prepared from an empirical formula, derived to fit measured sound-speed data obtained over the temperature range −3 C to 30 C, the pressure range 1.033 kg/cm² to 1000 kg/cm², and the salinity range 33°/₀₀ to 37°/₀₀. ***Wayne D. Wilson.*** *Acoustical Society of America, Journal*, v. 32, June 1960, p. 641-644.

11402 Propagation of Low-Frequency cw Sound Signals in the Deep Ocean. The acoustic field of a 10-cps cw source, towed at slow speeds at a depth of 24 m was measured by a stationary hydrophone out to ranges of about 70 km. The depth of the hydrophone was approximately 450 m. ***Albert N. Guthrie, Ivan Tolstoy, and John Shaffer.*** *Acoustical Society of America, Journal*, v. 32, June 1960, p. 645-647.

11403 A Numerical Solution for the Problem of Long-Range Sound Propagation in Continuously Stratified Media, With Applications to the Deep Ocean. ***I. Tolstoy and J. May.*** *Acoustical Society of America, Journal*, v. 32, June 1960, p. 655-660.

11404 Cloud Patterns as Seen From Altitudes of 250 to 850 Miles—Preliminary Results. The first synoptic detailed coverage of cloud patterns over large areas from high-flying ballistic missiles. ***John H. Conover and James C. Sadler.*** *American Meteorological Society, Bulletin*, v. 41, June 1960, p. 291-297.

11405* Temperatures Within the Earth. Internal structure of the earth; radiogenic heat; equation of heat conduction; surface heat flow; temperature in the mantle. ***John Verhoogen.*** *American Scientist*, v. 48, no. 2, June 1960, p. 134-159.

11406* Optimum Size of a Mine. The starting point in the analytical determination of the size studied is the natural factor of the supply of the deposit per unit of the surface of the mining field; at the same time the rate of exploitation must be considered as the determinant factor. General conclusions and directives were derived concerning the exploitation of new mines. (*In Polish.*) Optymalna wielkość kopalni. ***Bolesław Krupiński.*** *Archiwum Górnictwa*, v. 5, no. 1, 1960, p. 85-90.

11407* The Damping of Water Waves by Surface Films. Measurements were made of the stilling of small water ripples by surface films of cetyl alcohol. The damping is considerable and is somewhat in excess of that predicted by existing theories. ***R. G. Vines.*** *Australian Journal of Physics*, v. 13, no. 1, Mar. 1960, p. 43-51.

11408* Relationships Between Atmospheric Ozone and Earth Magnetism. Some particular cases of magnetic storms connected with a definite increase of the reduced density of atmospheric ozone were examined. Similar variations within two years were found for the two phenomena. (*In French.*) Relations entre l'ozone atmosphérique et le magnétisme terrestre. ***Arlette Vassy and Ishtiaq Rasool.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 250, no. 23, June 8, 1960, p. 3865-3866.

11409 Uses of Sonar in Oceanography. Scientists position underwater cameras and take samples of sea water and bottom sediments with the help of sonar in placing gear. ***Harold E. Edgerton.*** *Electronics*, v. 33, no. 26, June 24, 1960, p. 93-95.

11410* Estimation of Petroleum and Gas Reserves of Prospective Areas in Folded Oil and Gas Regions. (*In Russian.*) Ob otsenke zapasov perspektivnykh i prognoznykh ploshchadeĭ v skladchatykh neftegazonosnykh oblastiakh. ***M. V. Abramovich.*** *Geologiia Nefti i Gaza*, v. 4, no. 6, June 1960, p. 1-5.

11411* The Chemical Composition of Meteorites. Matter is being studied by determination of the main constituents of meteorites of different classes and determination of all the element contents including small admixtures in meteoritic matter according to their phases: metallic, silicate, and also in accessory minerals. ***A. A. Yavnel and M. I. Dyakonova.*** *International Geology Review*, v. 2, Apr. 1960, p. 298-310.

11412* Classification of Meteorites According to Their Chemical Composition. The most accurate classification was formulated by Prior. Definite properties were formed in the chemical composition of meteorites of all three classes, which allowed division of the classes into six subclasses: Ca-rich achondrites, Ca-poor achondrites, chondrites, siderolites (mesosiderites), lithosiderites (pallasites) and siderites. Meteorites are divided into five groups, evidently related to the separate generative bodies. ***A. A. Yavnel.*** *International Geology Review*, v. 2, May 1960, p. 380-396.

11413* Experimental Investigations of the Breaking of Coal From the Solid Mass. The optimum breaking time was found to be two hours, the optimum breaking depth 9 cm. Thus the highest content of large fractions in the products of fracture is obtained, and the specific breaking forces have minimum values. Forces necessary for breaking coal along the cleavage are higher than the forces perpendicular to the cleavage by 20 to 25%, and the volume of the fractured coal is lower by 20 to 25%. (*In Russian.*) Eksperimental'nye issledovaniia otryva uglia ot massiva. ***A. F. Kichigin, V. P. Kudiashov, A. D. Saltanov, and V. D. Iarema.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Gornyĭ Zhurnal*, 1960, no. 4, p. 97-105.

11414* Connection Between Gas Generation and Coal Disintegration. Expressed by an equation reflecting mechanism of the motion of gas in coal seams and accounts for the process of gas generation. Can be applied as a basis for further investigations of the approximate solution of a complex problem about determination of gas formation from outcrops of coal seams. (*In Russian.*) O sviazi mezhdu gasovydeleniem i razrucheniem uglia. ***B. G. Tarasov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Gornyĭ Zhurnal*, 1960, no. 5, p. 42-50.

11415* The Thermal Conductivities of Ocean Sediments. As a part of the measurement of heat flow through the ocean floor, the thermal conductivities of samples of sediment from the Pacific, Atlantic, and Mediterranean areas were determined in the laboratory by a steady-state method. Average values over a wide range of water content are found to depend more on water content than on solid phase constituents. ***E. H. Ratcliffe.*** *Journal of Geophysical Research*, v. 65, no. 5, May 1960, p. 1535-1541.

11416* Radar Detection of the Sea Breeze. Shows a clear-cut association between echoes and meteorological events. ***David Atlas.*** *Journal of Meteorology*, v. 17, no. 3, June 1960, p. 244-258.

11417* Results of Well Stimulation by Hydraulic Fracturing and High Rate Oil Backflush. Reports treatments in the Los Angeles basin Whittier fault trend in which large volumes of formation crude have been injected into the producing zone following hydraulic fracturing. ***W. K. Ghauri.*** *Journal of Petroleum Technology*, v. 12, June 1960, p. 19-27.

11418* The Effect of Some Drilling Variables on the Instantaneous Rate of Penetration. Theoretical approach to the drilling problem based on rock mechanics and drilling fluid hydraulics at the bottom of the hole. ***H. D. Outmans.*** *Journal of Petroleum Technology*, v. 12, June 1960, p. 137-149.

11419 Minerals and Monopoly—Formula for Soviet Strength. Discusses current knowledge of Soviet mineral wealth. ***Alexander Gakner.*** *Mining Engineering*, v. 12, June 1960, p. 557-565.

11420* Oil Sands of Alberta. Discusses possibility of exploiting the bituminous sands of the Athabasca River in Alberta, Canada. ***H. L. Holloway.*** *Mining Magazine*, v. 102, no. 6, June 1960, p. 337-342.

11421 Undersea Area Needs Fresh Thinking. Discusses devices necessary for adequate sub-surface research. ***Richard W. Van Hoesen and Marvin S. Weinstein.*** *Missiles and Rockets*, v. 7, no. 1, July 4, 1960, p. 22-24.

11422 Density of the Upper Atmosphere and Its Dependence on the Sun, as Revealed by Satellite Orbits. Variation of density between midnight and mid-day at heights above 500 km, has shown itself for six satellites and the day-time and night-time values revealed by each conform to a consistent pattern. ***D. G. King-Hele and D. M. C. Walker.*** *Nature*, v. 186, June 18, 1960, p. 928-931.

11423 Petroleum Engineering Drilling and Well Completions. Discusses nature of petroleum, concepts of petroleum geology and basic rock properties, petroleum-exploration methods and general leasing practices, cable-tool drilling, rotary drilling: general method and equipment, the composition, functions and general nature of rotary drilling fluids, rotary drilling hydraulics, factors affecting penetration rate, rotary drilling techniques and other problems. ***Carl Gatlin.*** 341 pp. 1960. Prentice-Hall, Inc., Englewood Cliffs, N. J. (TN870 G22p Over.)

11424* Electric Prospecting by the Telluric Currents Method. ***A. M. Zagarmistr and M. N. Berdichevskiy.*** *Petroleum Geology*, v. 3, no. 1-B, 1960, p. 40-49.

11425* Studies in Manurial Values of Seaweeds. I. Effects of Pachymenia Himantophora and Durvillea Antarctica Meals on Plant Growth. II. Effects of Pachymenia Himantophora and Durvillea Antarctica on the Immobilisation of Nitrogen in Soil. Chemical analyses have shown that *Durvillea* is richer than *Pachymenia* in cations and chloride but poorer in N and S. *Pachymenia* was found to stimulate growth on some soils and depress it on others. *Durvillea* depressed growth in all of the tests. Both the seaweeds were found to immobilize inorganic N in soils. ***R. I. B. Francki.*** *Plant and Soil*, v. 12, no. 4, June 1960, p. 297-323.

11426 The Upper Atmosphere as Observed With Rockets and Satellites. Emphasis on recent observations with rockets and satellites; reviews advances in understanding of the upper atmosphere which have occurred during and since the I.G.Y. ***William W. Kellogg.*** *Rand Corporation, Report P*-1813, Jan. 11, 1960, 9 pp. (T13 R15r Contin.)

11427 The Origin of the Solar System. Attempts to relate the problem of origin of solar system to the general problem of star formation. Gives reasons for concluding that interstellar material in which stars are about to be formed consists of fragments ("floccules") moving at random amonsgt themselves and probably composed mainly of molecular H. ***W. H. McCrea.*** *Royal Society, Proceedings*, v. 256, ser. A, June 21, 1960, p. 245-266.

11428 The Zodiacal Light. On a clear, dark night in the tropics a luminous pyramid is seen in the sky after sunset and before sunrise. The phenomenon seems to be caused by scattering of sunlight by interplanetary dust. ***D. E. Blackwell.*** *Scientific American*, v. 203, no. 1, July 1960, p. 54-63.

11429 The Sea Off Southern California. A Modern Habitat of Petroleum. Claims that studies of this area over the last 120 years have brought the state of knowledge of the submerged area off southern California to a very high level as compared to that of any other area of the ocean having a similar size and complexity. Knowledge of the inter-relationships of geography and processes off southern California may serve as a guide to what may be expected in other less well-known regions of the sea floor. Attempts to describe the basic environmental factors of the region and relate them to each other and, whenever possible, to the general problem of origin and accumulation of petroleum. ***K. O. Emery.*** 366 pp. 1960. John Wiley & Sons, New York. (GC83 Em36s)

11430 On the Structure of the Sunspot Zone. Published data are used to study the structure of sunspot zone as a function of heliographic latitude. ***Barbara Belt.*** *Smithsonian Contributions to Astrophysics*, v. 5, no. 3, 1960, 28 pp. (QB1 Sm69.1c Contin.)

11431 Some Solar Radiation Data Presentations for Use in Applied Solar Energy Programs by an International Group of Authors. Examples of statistical representation of radiation data; frequency distribution of hourly sums of direct solar radiation at Potsdam; radiation balance of slopes; and number of days with solar radiation above or below specific values. *Solar Energy*, v. 4, no. 1, Jan. 1960, p. 1-22.

11432 Two Atmospheres. Considers solar particles travelling in individual orbits which form a definite and finite atmosphere—particles of which do not touch the earth—in the region beyond the familiar fluid atmosphere which rests upon the earth's

surface. ***Grandison Gardner.*** *Solar Energy*, v. 4, no. 1, Jan. 1960, p. 28-31.

11433* Treatment and Recovery Practice at Kimberley Mines of de Beers Consolidated Mines, Limited. ***E. Colvin and H. S. Simpson.*** *South African Institute of Mining and Metallurgy, Journal*, v. 60, no. 10, May 1960, p. 503-524.

11434 A System of Standard Atmospheres. Devised for defining vertical variations of temperature and pressure; these atmospheres approximate mean conditions over Eurasia, as deduced from limited climatological data. A body of data for North America, comprising over 57,000 observations, is compared with these atmospheres, and it is concluded that temperature-height curves will approximate ambient conditions over the Northern Hemisphere at least 70% of the time. ***B. N. Charles.*** *U. S. Atomic Energy Commission, SCR-183*, May 1960, 37 pp. (UF767 Un3.1scr Contin.)

11435 Exploratory Drilling Practices and Costs at Western Uranium Deposits. ***D. E. Redmon.*** *U. S. Bureau of Mines Information Circular* 7944, 1960, 68 pp. (TN21 Un3i Vis.)

11436 Use of Sonic Techniques in Exploring Coal-Mine Roof Strata: A Progress Report. Work confirmed the validity and potential usefulness of the method. ***Charles E. Mongan, Jr. and Thomas C. Miller.*** *U. S. Bureau of Mines Report of Investigations* 5617, 1960, 15 pp. (TN21 Un3r Room 290)

11437 Discovery of Electrons With an Energy of About 10 Kev in the Upper Atmosphere With the Aid of the Third Earth Satellite. A test aimed at the direct detection of moderately hard electrons in the upper atmosphere was conducted aboard the third Soviet earth satellite launched on May 15, 1958. When the experiment was set up, it was not expected that the intensity of electron streams would be so high. Higher values of "equivalent" electron energy were recorded at lower latitudes. The maximum recorded value was 40 kev. In polar regions, only the lowest values of the order of 10 kev were recorded. ***V. I. Krasovskiy, I. S. Shklovskiy, Yu. I. Gal'perin, and Ye. M. Svetlitskiy.*** *U. S. National Aeronautics and Space Administration, Technical Translation, NASA-TT-F-39*, June 1960, 7 pp. (TL570 Un3tm Room 290)

See also: **11101** (petroleum technology); **11118** (bentonite); **11790** (diamond; solid state physics of).

GRAPHIC ARTS

11438* Accelerating Effect of Sound Irradiation of Photographic Development. Heating the base layer of photographic paper during its exposure to ultrasound causes increase of photometric density of image by about 15%, irrespective of sound intensity. Acoustic wind cannot cause a noticeable increase of photometric density, but only produce a lubrication of the image and an increase of heat transfer by convection between photographic material and developing medium. (*In Russian.*) Uskoriaiushchee deĭstvie zvuka na protsess proiavleniia fotograficheskoĭ emul'sii. ***M. E. Arkhangel'skiĭ.*** *Akusticheskiĭ Zhurnal*, v. 6, no. 2, 1960, p. 180-186.

11439 Television X-Ray Movies: Dose and Contrast Factors. A television link with nonlinear circuits aids X-ray movie production by allowing concentration on a small brightness range, and dose can be determined by the detail to be observed rather than film properties. ***R. Stuart Mackay.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 2, Apr. 1960, p. 80-86. (TK1 In6.6m Vis.)

11440* Testing the Suitability of the Crown Graphic Camera for Photogrammetry. A series of tests to determine the quality of photogrammetric work to be expected from photographs made with the press-type Crown Graphic camera used precisely measured targets to give photograph scales varying from 1:1 to 1:100. Measurements taken from these photographs were compared with actual object dimensions. Curves prepared showing errors to be expected for different conditions reveal that the quality checks compare well with those obtained from precise aerial cameras or photo-theodolites. ***Robert D. Turpin.*** *Photogrammetric Engineering*, v. 26, no. 3, June 1960, p. 436-440.

11441 Ballistics-Range Applications of Millimicrosecond Photography. The Kerr cell electro-optical shutter was adapted to obtain millimicrosecond, high-resolution photographs of models fired on a ballistic range. Sixteen stations employing these shutters are used to obtain aerodynamic data on nose cone models fired at velocities to 14,000 ft/sec. Energy stored in the Kerr cell pulse generator is used to generate the light pulse necessary for making shadowgraph and schlieren exposures. ***J. A. Hull and G. A. Theophanis.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, May 1960, p. 355-357.

11442 Special-Effects Cinematography: A Bibliography. Books, unpublished research papers, articles in books, articles in journals, optical printing and traveling mattes, minatures, special-effects production, fundamentals of special-effects cinematography, etc. ***Raymond Fielding.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, June 1960, p. 421-424.

11443 An Infrared Self-Matting Process. Describes a traveling matte process in which advantage is taken of the selective sensitivity of film emulsions toward light, plus and minus infra-red rays; explains how these two exposures are taken simultaneously and these components then used to arrive at a composite. ***Zoli Vidor.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, June 1960, p. 425-427.

11444* On the Television Motion Picture Image Quality When Producing Films by the Electronic Method. Quality of the motion picture film as a material for taking the TV picture, joint effect of television and motion picture transmission systems on quality of image, possibilities of improvement of quality of motion-television pictures are discussed. (*In Russian.*) O kachestve kinotelevizionnogo izobrazheniia pri proizvodstve fil'mov elektronnym metodom. ***V. A. Burgov.*** *Tekhnika Kino i Televideniia*, 1960, no. 5, May, p. 4-12.

11445* Research of Black-and-White Film Processing in the Photographic Solution Streams. Discusses peculiarities of kinetics of basic processing of a black-and-white film in the photographic solution streams. Results of experimental investigation of the dependence of velocity of development and fixation processes on basic hydrodynamic parameters are cited. (*In Russian.*) Issledovanie osnovnykh parametrov obrabotki chernobeloĭ kinoplenki v struiakh fotograficheskikh rastvorov. ***B. V. Valuĭsky.*** *Tekhnika Kino i Televideniia*, 1960, no. 5, May, p. 44-51.

HEAT POWER

11446 An Experimental Investigation of Fuel Additives in a Supercharged Boiler. To permit the use of high-vanadium residual oil as fuel for combined super-charged-boiler gas-turbine power plants, it is necessary to determine the treatment required to prevent high-temperature corrosion and deposit problems associated with this fuel. ***R. J. Zoschak and R. W. Bryers.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 82, no. 3, July 1960, p. 169-180.

11447 Arc-Jet "Push" for Satellites. Electric propulsion system evolves from re-entry studies. Prototype runs give 0.75 lb thrust for 47 hr. ***Peter Sigmund.*** *Aircraft and Missiles*, v. 3, July 1960, p. 58.

11448 Principles of Thermoelectric Devices. By using semiconducting compounds of high mean atomic weight, Seebeck coefficients of about 200 μV/° C were obtained without the ratio of electrical to thermal conductivity departing too far from the value given by the Wiedemann-Franz law for metals. Devices employing the thermoelectric effects are discussed. ***H. J. Goldsmid.*** *British Journal of Applied Physics*, v. 11, June 1960, p. 209-217.

11449 Turbojet Thrust Augmentation. Flight Test Results for a Reheat System Employing Fuel Injection Upstream of a Two-Stage Turbine. The system was fitted to an Orenda 14 engine installed in a Sabre 6 aircraft. ***E. P. Cockshutt, et al.***

Canada, National Research Council, Aeronautical Report LR-272, Jan. 1960, 51 pp. (TL501 C16.5L Contin.)

11450* The Combustion Engine. Recent Progress. Mechanical, thermal and chemical problems and solutions connected with the Diesel engines including: means to increase engine efficiency, two-stroke cycle, recent tendencies in engine designs from point of view of fatigue and weight, overfeed in four-stroke and two-stroke engines. (*In French.*) Le moteur à combustion. Progrès récents. ***P. Lorain.*** *Chaleur & Industrie*, 1960, no. 418, May, p. 123-139.

11451* Some Properties of Carbonaceous Deposits Accumulated in Internal Combustion Engines. Engine "carbon" contains 20 to 30% O, most of which is bound in acid and ester carbonyl groups. Carbonaceous engine deposits most likely originate in an oxidative pyrolysis of fuel and lubricant. ***J. L. Lauer and P. J. Friel.*** *Combustion and Flame*, v. 4, no. 2, June 1960, p. 107-115.

11452 Electric Space Propulsion. General characteristics of electric propulsion systems for space vehicles, energy sources and conversion efficiencies available, projected powerplant weights, and some of the various schemes for generating ion and plasma jets are given. ***J. C. Evvard.*** *Electrical Engineering*, v. 79, July 1960, p. 555-563.

11453* A Contribution of the Problem of Heat Exchange in the Case of Bubbling Boiling. Gives average values of the coefficients of heat emission depending upon pressure, concentration, and heat charge; tests were generalized for the case of water at different pressure and for Li salts solutions in large volume. (*In Russian.*) K voprosu o teploobmene pri puzyr'kovom kipenii. ***F. P. Minchenko.*** *Energomashinostroenie*, v. 6, no. 6, June 1960, p. 17-21.

11454 Exotic Power Packages. Illustrated description of solar cell, thermoelectric, fuel cell, thermionic, and magnetohydrodynamic power generators. ***George A. W. Boehm.*** *Fortune*, v. 62, no. 1, July 1960, p. 124 + 8 pages.

11455* Gas Turbine Power Generation for Ground Support Equipment. Discusses problem and recommends gas turbine. ***F. H. Ford, Jr., and J. K. Hubbard.*** *GSE; Ground Support Equipment*, v. 2, no. 3, June-July 1960, p. 56 + 4 pages.

11456* Limitations and Possibilities for Improvement of Photovoltaic Solar Energy Converters. I. Considerations for Earth's Surface Operation. Explains seven factors limiting performance of photovoltaic solar energy converters. Can be classified into basic and technology determined limitations. Possibilities for improvement on technology determined limitations are investigated for the Si solar cell: heavier *p*-layer doping; change of geometry, possibly by application of grid structures; improvement of material constants; and utilization of drift fields for improved collection. ***M. Wolf.*** *I.R.E. Proceedings*, v. 48, July 1960, p. 1246-1263.

11457 Performance of Nuclear Rocket for Large-Payload, Earth-Satellite Booster. Performance of single-stage, heat-transfer-type nuclear rockets using either dispersed-fuel-in-graphite reactors or W-fuel-element-in-BeO reactors with H as propellant is evaluated for large-payload, earth-satellite missions. Presents reactor and nuclear rocket performance for several reactor sizes. Graphite reactor offers lower U investments. ***Eldon W. Sams.*** *Journal of the Aero/Space Sciences*, v. 27, July 1960, p. 481 + 12 pages.

11458* Experimental Tasks to Be Faced When Developing Turbojets. Draws special attention to the aerodynamic, thermodynamic, and performance tests and gives short descriptions of the respective test-bench equipment created for this purpose. (*In German.*) Versuchsaufgaben bei der Entwicklung von Turbinentriebwerken. ***H. G. Münzberg and O. David.*** *Luftfahrttechnik*, v. 6, June 1960, p. 171-180.

11459* Fuel Cells—Almost Here. Discusses fuel cells in general; Zn-O cells, fuel gas cells, C cells, hydrox cells, carbox cells, sodium amalgam cells and redox cells in particular. ***Dick Dietz.*** *Material Handling Engineering*, v. 15, no. 10, July 1960, p. 50-53.

11460* The Economic Use of Conventional and Nuclear Fuel. *F. A. P. M. Theunissen.* *Nuclear Power*, v. 5, July 1960, p. 76-79.

11461* The Direct Generation of Electricity. Magnetohydrodynamics and the fuel cell. ***B. C. Lindley.*** *Nuclear Power*, v. 5, July 1960, p. 80-83.

11462* Nuclear Power for Space. Large-capacity atomic-powered electric generating plants must be developed in time to give our increasingly complicated satellite payloads the energy they will need to operate for long periods. ***Frank H. Featherston.*** *Ordnance*, v. 45, July-Aug. 1960, p. 144-145.

11463* Magnetohydrodynamics—The Possible Future of Energetics? Report on combustion at very high temperatures leading to ionization of fuels and, on the basis of newly discovered effect, to direct transformation of heat into electric power. The efficacy of transformation with a d.c. of 2500 V would be about 96%. (*In Polish.*) Magnetohydrodynamika przyszłość energetyki? ***Władysław Ney.*** *Przegląd Techniczny*, 1960, no. 21, May, p. 16-17.

11464* A Hypersonic Ramjet Using a Normal Detonation Wave. Utility of conventional ramjets at hypersonic speeds is seriously limited due to performance deterioration and growing structural complexity, as flight speed increases. Some associated problems can be alleviated by operating the engine combustion chamber at supersonic mean inlet velocities. Performance of an ideal detonative ramjet using acetylene fuel is presented for flight Mach numbers of 6 to 10. A ramjet engine configuration is suggested for performance with normal detonation. ***M. Arens.*** *Research Council of Israel, Bulletin*, v. 8C, no. 1, Feb. 1960, p. 35-46.

11465 A New Tool for Combustion Research. A quartz piston engine—developed at GM Research—permits an unobstructed view of the combustion processes occurring in overhead-valve combustion chambers at compression ratios as high as 10.7/1. ***Fred W. Bowditch.*** *SAE Journal*, v. 68, July 1960, p. 32-34.

11466 Hydrocarbon-Air Fuel Cell Can Operate Motor Vehicle Economically. Great increase in amp/sq ft is still needed for performance; initial cost is still high. ***E. A. DeZubay.*** *SAE Journal*, v. 68, July 1960, p. 35-37.

11467 Nuclear Aircraft Attain Best Productivity With— Turboprop engine, cruise speed of 0.55 Mach number, low cruise altitude. ***D. P. Lalor and W. C. Schmill.*** *SAE Journal*, v. 68, July 1960, p. 46-47.

11468 Conversion of Sun Radiation to Electricity. Suggests an apparatus, without moving parts, which, if placed in a region containing a large number of nuclear particles, would separate and capture them by a method analogous to the separation of ions in a storage battery. ***Grandison Gardner.*** *Solar Energy*, v. 4, no. 1, Jan. 1960, p. 25-26.

11469 Power Sources for Satellites and Space Vehicles. Solar-energy converters with or without storage devices will offer high power for operation over at least several years. Nuclear devices under development also show promise. ***Harold A. Zahl and Hans K. Ziegler.*** *Solar Energy*, v. 4, no. 1, Jan. 1960, p. 32-38.

11470 Clustering: Short Cut to High Rocket Performance. Provides thrust gains that would otherwise require several years to develop. Precise ignition is the worst problem. ***Kurt R. Stehling.*** *Space/Aeronautics*, v. 34, no. 1, July 1960, p. 45-47.

11471 Fuel Cells . . . Electrical Energy From an Electrochemical Process. One of four papers on future power sources. ***J. Weissbart and R. Ruka.*** *Westinghouse Engineer*, v. 20, no. 4, July 1960, p. 108-110.

11472* The Economics of Very Large Turbine Generator Units. Study of units of 300 to 500 megawatts capacity indicates further economies with much larger units, at least up through 800 megawatts. ***John R. Carlson.*** *Westinghouse Engineer*, v. 20, no. 4, July 1960, p. 111-115.

See also: **11097** (solar heat exchangers); **11129** (natural frequencies of fluids in tanks); **11500** (lubricants for gas turbines).

INFORMATION—PREPARATION AND DISSEMINATION

11473 The Automatic Retrieval of Technical Information. Description of a system, using punched paper tape for retrieval of documents, by author, title, place and date of publication, and subject, employed at the Fluid Mechanics Division of the National Engineering Laboratory of the Department of Scientific and Industrial Research. ***W. H. P. Leslie.*** *American Documentation*, v. 11, no. 3, July 1960, p. 210-219.

11474 Indexing of Metal and Thermit Corporation Research Records on Keysort Cards. Describes method using Keysort cards supplemented by other controls for analysis of research records, note books, reports, technical correspondence, market reports, stabilized evaluation tests, and shipping records. File emphasizes halogenated synthetic resins and their stabilization against deteriorating effects of heat and light. ***Marguerite K. Moran.*** *American Documentation*, v. 11, no. 3, July 1960, p. 222-228.

11475* The Next Twenty Years in Information Retrieval. At present, there still are no completely satisfactory machines for retrieval from large collections. Solution of the language problem in retrieval is currently somewhat ahead of machine development. Retrieval machines will soon be called upon to assist the customer in using a retrieval system by helping him to formulate his search requests. ***Calvin N. Mooers.*** *American Documentation*, v. 11, no. 3, July 1960, p. 229-236.

11476* Bibliography on the Economic and Social Implications of Scientific Research and Development. Increased utilization of scientific and engineering manpower as well as increased expenditures for research have far-reaching socio-economic implications, which have aroused the interest of social scientists. Objective is to furnish a review of books and articles reflecting this new interest. 53 pp. 1959. National Science Foundation, Washington 25, D. C. (Z7405.R4 N21.7b Ref.)

11477* Design of Technical Documents. Much has been published on the subject of technical writing; describes essential basis for a well laid out document. ***F. Machon.*** *Engineering Materials and Design*, v. 3, July 1960, p. 426-428.

11478 Information Processing. Proceedings of the International Conference on Information Processing, Unesco, Paris, June 15-20, 1959. Methods of digital computing, common symbolic language for computers, automatic translation of languages, pattern recognition and machine learning, logical design of computers, special session on computer techniques of the future, and miscellaneous topics. 520 pp. 1960. Butterworths, London. (Z1001 In8i)

11479 How to Check the Russian Literature. Names 34 Russian periodicals, which are the most important in publishing chemical engineering articles. ***Laurence W. Ross.*** *Petroleum Refiner*, v. 39, July 1960, p. 143-144.

11480* Names of Chemical Compounds in Swedish. Names of chemical compounds are used by a large section of the Swedish population and not by specialists alone. Advisable to treat them as ordinary Swedish words and especially to spell them according to the usual (phonetic) rules—as has been done in the new Swedish inorganic nomenclature. Some parallels are drawn between the present English and Chinese languages. (*In Swedish.*) Om kemiska amnesnamn i svenskan. ***Lars Gunnar Sillén.*** *Svensk Kemisk Tidskrift*, v. 72, no. 4, 1960, p. 303-309.

See also: **11218** (bibliography on electrical properties of porcelain enamels).

INSTRUMENTATION

11481* Temperature Compensated Strain Gauges. In the Napier Research Laboratories, gauges have been developed which compensate for temperature change over wide ranges. These use thermocouples to develop a voltage which compensates for the signal voltage resulting from temperature changes, leaving only the signal due to the applied stress. ***R. L. Chandler and E. J. Dent.*** *Electronic Engineering*, v. 32, July 1960, p. 414-421.

11482 Instrumentation for Complex Signal Environment Testing. Simulation system and program present a realistic approach for testing and evaluation of receivers, data analysis and display systems for a complex, high-density signal environment. ***D. Krueger and G. Herlt, Jr.*** *IRE Transactions on Instrumentation*, v. 1-9, no. 1, June 1960, p. 13-18. (TK In6.6i Vis.)

11483 Millimicrosecond Pulse Instrumentation for Microwaves. Discusses switching, observation of switching characteristics, pulse instrumentation systems. ***James T. Tippett.*** *IRE Transactions on Instrumentation*, v. 1-9, no. 1, June 1960, p. 32-34. (TK In6.6i Vis.)

11484 A Diode Matrix Commutator With Transistor Flip-Flop Switching. Commutator has a complex switch and a simple control. Only three bistable multivibrators are needed for the control and they can be connected in cascade. ***Spurgeon L. Robinette.*** *IRE Transactions on Instrumentation*, v. 1-9, no. 1, June 1960, p. 40-42. (TK In6.6i Vis.)

11485 X-Ray Visualization and Analysis Using Spectral Information. Describes an electronic X-ray system which allows more information to be obtained than do the usual radiographic methods which lump together the effects of different wavelengths. Gives high contrast images and allows otherwise unnoticeable detail to be detected with a quantitative evaluation of composition. ***R. Stuart Mackay.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 2, Apr. 1960, p. 77-79. (TK1 In6.6m Vis.)

11486 Deflection Focusing of Electron Microscopes. An image in an electron microscope is made to move in response to manipulation of a switch if the image is slightly out of focus. Because of the sensitivity of the eye to motion, even low contrast or dim images can thus be focused very accurately by noting lack of motion. ***R. Stuart Mackay and Norman T. Seaton.*** *IRE Transactions on Medical Electronics*, v. ME-7, no. 2, Apr. 1960, p. 87-94. (TK1 In6.6m Vis.)

11487* Use of Thermistors for Error Integration in Carrier Type Servomechanisms. Presents a simple method of introducing integral error compensation in carrier type servomechanisms. Error signal is fed to separate proportional and integral channels, where two indirectly heated thermistors are used in the integral channel to perform demodulation, desired integration and modulation. ***A. Solbakken.*** *Instrument Practice*, v. 14, June 1960, p. 642-646.

11488 Laboratory Magnetic Elutriator for Purification and Isolation of Ferrimagnetic Mineral Sands. Apparatus allows almost total removal of not-completely homogeneous magnetic grains from ferrimagnetic mineral sand, and will further separate strongly remanent from weakly remanent grains. ***W. R. B. Martin.*** *Journal of Scientific Instruments*, v. 37, June 1960, p. 212-215.

11489 Do It Yourself: A $10 Vacuum Pump. Describes "ice-pumping" method, where a water aspirator replaces the mechanical pump. ***William Beller.*** *Missiles and Rockets*, v. 7, no. 2, July 11, 1960, p. 28 + 1 page.

11490* Modern Developments in Optical Instruments. Introduces a unified treatment of an optical instrument. Describes developments in materials, components, and design, and a number of optical instruments, with some consideration to future directions of development. ***G. E. Fishter and J. H. Bach.*** *Society of Instrument Technology, Transactions*, v. 12, no. 2, June 1960, p. 90-100.

11491* Errors Occurring in Sedimentation Analysis Through the Flow of Bodies in the Sedimentation Tank. In sedimentation analysis for particle-size determination of dusts, an error always occurs as a result of flow caused by density differences when a body dips into the suspension. This flow error and its relationship to the geometrical dimensions of the apparatus are examined for sedimentation analysis using the Andreasen pipette and the Bachmann sedimentation balance. (*In German.*) Die Störung der Sedimentationsanalyse durch das Umströmen von Körpern im Sedimentationsgefass. ***W. Kast.*** *Staub*, v. 20, July 1960, p. 205-211.

11492* Points of View Concerning Industrial Instrumentation. Experience gained from planning and introducing automatic methods and equipment in a chemical plant. Emphasis was placed on problem of working according to a long-term plan, and of forming a planning group which is able to judge and handle problems of automation on the background of general modernization and development problems of the whole plant. Gives examples of application of sequence control for a hydrogenation process. (*In Norwegian.*) Synspunkter i forbindelse med industriell instrumentering. ***Wilhelm Blakstad.*** *Teknisk Ukeblad*, v. 107, no. 22, June 2, 1960, p. 461-470.

LUBRICATION AND FRICTION

11493* A Dynamic Theory of Piston-Ring Lubrication. Experimental study was made on the dynamics of piston-ring lubrication. Apparatus used had a stationary piston and a moving cylinder, the speed of which could be accelerated to 2000 rpm, and a constant or varied load was applied to the piston-ring. ***Shoichi Furuhama.*** *Bulletin of JSME*, v. 3, no. 10, May 1960, p. 291-297.

11494 Friction and Wear. Proceedings of the Symposium on Friction and Wear, Detroit, 1957. Describes a tentative model for the mechanical wear process, energy losses of balls rolling on plates, some metallurgical aspects of friction and wear, seizure of metal pairs during boundary lubrication, recent experimental studies of solid friction, friction, durability and wettability properties of monomolecular films on solids, study of stick-slip process, and cohesion between two oriented single crystals of Cu. ***Robert Davies, editor.*** 191 pp. 1959. Elsevier Publishing Co., New York. (QC197 Sy68f)

11495* Stationary Turbo Generators. In most instances the source of energy used to generate electricity where turbines are used as prime movers does not materially change the lubrication requirements. Advances in generating equipment design have been paralleled by development of modern inhibited oils which provide lower maintenance requirements with longer and more reliable operation. *Lubrication*, v. 46, July 1960, p. 93-104.

11496* Material Handling and Processing Aids in the Manufacturing of Grease. A kettle vent, low rpm kettle drive, grease strainers, handling of graphite and zinc dust, method of closing converted open top drums, and bulk movement of grease to small packaging operations are discussed. ***S. E. Hendricks and R. S. Stoops.*** *NLGI Spokesman*, v. 24, no. 4, July 1960, p. 129-132.

11497* Three-Dimensional Lubrication Under Turbulent Conditions. Considers distribution of velocities of a lateral flow in the lubrication layer applying the hypothesis of path of displacement of Prandtl and results previously obtained. Approximate relations with dependency of lateral consumption on change of pressure were determined. A differential equation was obtained for the case of bearings of finite length. (*In Russian.*) O trekhmernoĭ smazke pri turbulentnom rezhime. ***V. N. Konstantinesku.*** *Revue de Mécanique Appliquée*, v. 5, no. 1, 1960, p. 47-66.

11498* Development in Lubricant Additives. Discusses calcium petroleum sulfonates, stable oil/water emulsions and multifunctional additives. ***E. G. Curpher.*** *Scientific Lubrication*, v. 12, June 1960, p. 26-27.

11499 Friction and Wear at Elevated Temperatures. A new high-temperature friction apparatus was constructed which allows sliding experiments to be carried out at temperatures to 2000 F, in controlled atmospheres, and at speeds varying over a wide range. Tests were run on this machine and on an older machine. Discusses these and other results theoretically. ***Ernest Rabinowicz.*** *U. S. Air Force Wright Air Development Division, WADD Technical Report* 59-603, Jan. 1960, 21 pp. (TL507 Un3.18w Vis.)

11500 Lubricating Oils for Aviation Gas Turbines. Laboratory testing methods cannot fully reproduce the behavior of oils under operational conditions. Accordingly, the ultimate serviceability of gas turbine engine lubricating oils is assessed on the basis of results of tests on individual frictional assembly installations of engines and on full-scale engines. In certain cases, oils are tested under in-flight conditions. ***V. V. Panov and Yu. S. Sobolev.*** *U. S. National Aeronautics and Space Administration, Technical Translation, NASA TT-F-21*, May 1960, 82 pp. (TL570 Un3tm Room 290)

MECHANICAL ENGINEERING

11501* Bending of Short Beams. Investigates question of change in stressed state of a short beam on replacing a concentrated force by a uniform load distributed over a small area. Problem is solved by method of a compensating load. (*In Ukrainian.*) Zgyn korotkykh balok. ***N. A. Peklov.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, 1960, no. 3, p. 322-326.

11502* Instantaneous and Long-Time Deflections of Reinforced Concrete Beams Under Working Loads. Availability of high-strength steels and concretes and acceptance of ultimate strength design make it possible to utilize much shallower flexural members than in the past. Presents two simple methods, each, for calculating instantaneous and long-time deflections under service loads. Methods are checked against results of 175 deflection tests from nine different investigations. Agreement is found to be uniformly satisfactory for design purposes. ***Wei-Wen Yu and George Winter.*** *American Concrete Institute, Journal*, v. 32; *ACI Proceedings*, v. 57, no. 1, July 1960, p. 29-50.

11503* Shear Strength of Restrained Concrete Beams Without Web Reinforcement. Tests of two series of reinforced concrete beams without web reinforcement were made to investigate the behavior in shear of restrained beams. Shows that the effect of shear on the behavior of restrained beams is essentially the same as that observed for simple beams: shear affects load-deformation characteristics and strength of a beam through formation of diagonal tension cracks. The first diagonal tension crack forms at a section subjected to both moment and shear. ***John E. Bower and Ivan M. Viest.*** *American Concrete Institute, Journal*, v. 32; *ACI Proceedings*, v. 57, no. 1, July 1960, p. 73-98.

11504* On the Tension of an Infinite Strip Containing a Square Hole With Rounded Corners. Tension problem is treated by the method of perturbation. Convenient formulas for the stress are given and numerical results are examined. ***Makoto Isida.*** *Bulletin of JSME*, v. 3, no. 10, May 1960, p. 254-259.

11505 The Study of Fuel Oil Pumpability Using a Laboratory Pumping Rig. Shows that the increase in flow rate on starting up with the pipe full of cold oil is very similar to increase in rate of shear when the oil is sheared in a coaxial cylinder viscometer at the constant shear stress applied to the pipe. Once steady flow conditions are established there is some evidence that the shear stresses, and hence viscosity, in the first section of the line are greater than those in the last two sections. ***D. Wyllie and J. T. Jones.*** *Institute of Petroleum, Journal*, v. 46, May 1960, p. 161-176.

11506 Pneumatic-Power Systems. II. Directional Control and Circuit Selection. Discusses directional control and circuit selection-operating characteristics of directional-control components; suggestions on their application. ***I. Leonard Kaplan.*** *Machine Design*, v. 32, July 7, 1960, p. 123-129.

11507* Investigating and Calculating the Rigidity of Universal Boring Machine Columns. The greatest rigidity to torsion occurs in elements having a shape close to circular or close to square. The effect of dividing walls on column rigidity under bending without distortion of contour and under torsion is extremely small. Effect of longitudinal ribs on the displacements due to bending does not exceed 10-20%. ***V. V. Kaminskaya and E. A. Kunin.*** *Machines and Tooling* (Translation of *Stanki i Instrument*), v. 31, no. 2, Feb. 1960, p. 2-12.

11508* Free Vibrations of Lightly Damped Systems by Perturbation Methods. The problem of small vibrations of a conservative mechanical system is formulated. Develops a method by means of perturbation theory for estimation of frequencies, rates of decay, and modes of vibration of the system when small damping forces are introduced. Analysis is based on

a prior knowledge of the natural frequencies and principal modes of the undamped system. ***P. Lancaster.*** *Quarterly Journal of Mechanics and Applied Mathematics,* v. 13, pt. 2, May 1960, p. 138-155.

11509* Plane Strain and Axially Symmetric Problems of the Consolidation of a Semi-Infinite Clay Stratum. Two problems of the semi-infinite body to the surface of which a uniform pressure is applied along an infinite strip or over a circular area are treated here in parallel. Expressions for quantities of engineering significance are derived when the surface is either fully permeable or completely impermeable to the flow of pore water; discusses relation to the solutions of the equivalent elastic problems. ***John McNamee and R. E. Gibson.*** *Quarterly Journal of Mechanics and Applied Mathematics,* v. 13, pt. 2, May 1960, p. 210-227.

11510* Torsion-Free Stress Systems in a Thick Plate Containing a Spherical Cavity. The plate is considered to be infinitely extended in two dimensions and the center of the cavity to be midway between the faces. It is supposed that the surface tractions specified over the boundaries are continuous, axially symmetric, and torsion-free. The resulting strains are assumed to be everywhere sufficiently small for the classical theory of elasticity to be employed. ***N. Fox.*** *Quarterly Journal of Mechanics and Applied Mathematics,* v. 13, pt. 2, May 1960, p. 228-246.

11511* New Shell Theory and Methods of Calculation. By applying tensor calculus, a system of differential equations is developed for the displacements valid for all types of shells in arbitrary coordinates. Use of tensor calculus seems to be very advantageous for investigations of this kind. Method of treating a conoid shell analytically is shown. (*In Norwegian.*) Nyere skallteori og beregningsmetoder. ***Jan Stageboe.*** *Teknisk Ukeblad,* v. 107, no. 25, June 23, 1960, p. 537-540.

11512* How to Apply Pneumatic Power. I. Some Basic Circuits. Air cylinders and air motors provide efficient and reliable actuation for fixtures, machines, presses and automation equipment. ***H. L. Stewart.*** *Tool Engineer,* v. 45, no. 1, July 1960, p. 50-55.

11513* Stick-Slip. What It Is—What to Do About It. The detrimental effects of stick-slip persistently plague mechanical designers. Presents an analysis of how and where stick-slip occurs and gives design approaches to take to minimize or eliminate it in machine tools. ***Harry Conn.*** *Tool Engineer,* v. 45, no. 1, July 1960, p. 61-65.

11514 Stresses and Deflections Due to Local Loadings on Cylindrical Shells. An interpretive commentary on the application of theory to experimental results. ***P. P. Bijlaard and E. T. Cranch.*** *Welding Journal,* v. 39, July 1960, p. 306s-308s.

See also: **11674** (design of powder-metal parts); **11866** (mechanical shaft seals); **11869** (vibration of fans).

METALLURGY

11515* Choice, Manufacture and Economics of a Low-Alloy High-Tensile Structural Steel. A review of the literature in relation to corrosion resistance imparted by various alloying elements was made and, after consideration of their effect on mechanical properties and weldability, a low-alloy high-tensile steel was developed conforming to A.S.T.M. A.325 and equivalent specificatons. To reduce the cost of production, the steel can be successfully produced by balanced deoxidation methods using big-end-down ingot molds. ***W. O. Beale.*** *Australian Institute of Metals, Journal,* v. 5, no. 1, May 1960, p. 38-44.

11516 Preparation and Properties of AlSb-GaSb Solid Solution Alloys. Ingots of the quasi-binary GaSb-AlSb alloy were prepared by progressive casting and zone casting at various rates of crystallization. Results of X-ray diffraction studies, metallographic studies, hardness determinations, and chemical analyses indicate that, with the possible exception of a narrow composition range between 10 and 30 mole % AlSb which was not investigated, solid solution prevails in the system. Vegard's law was found to be at least roughly applicable; with the lattice constants for the alloys ranging between values of 6.0963 Å for pure GaSb and 6.1361Å for pure AlSb. Optical energy gaps determined for alloy specimens increased regularly with cell size from a value of 0.68 ev for GaSb to a value of 1.74 ev for AlSb. ***J. F. Miller, H. L. Goering, and R. C. Himes.*** *Electrochemical Society, Journal,* v. 107, June 1960, p. 527-533.

11517* Manufacture and Properties of New Fe-Al Alloys. Attention was paid to the heat resistance of these alloys in the temperature range between 1000 C and 1250 C. On the basis of tests performed, some mechanical values of the alloys under examination were checked and data completed of their corrosion resistance in chosen media of elevated aggressivity. (*In Czech.*) Výroba a vlastnosti nových slitin železa s hliníkem. ***Miloslav Vyklický and Adolf Kabrhel.*** *Hutnické Listy,* v. 15, no. 4, Apr. 1960, p. 260-266.

11518* Ingot Brass and Bronze. Economy and utility, BBII standard alloys, miscellaneous specifications, mechanical and physical properties of three low-shrinkage, copper-base casting alloys, creep properties of three copper-base casting alloys, foundry practice and foundry defects are discussed. Sections individually paged. Mar. 1960. Brass and Bronze Ingot Institute, Chicago. (TS565 B73i)

11519 New Furnace Permits Recovery of Reactive Metal Scrap. Melting of Ti scrap and casting into usable ingots can be difficult, costly, and sometimes dangerous. Describes how a new furnace solves this problem. *Iron Age,* v. 185, no. 25, June 23, 1960, p. 108-109.

11520* Ultra-Pure Aluminum. New ultra-pure electronic metal used for miniature transistors, diodes and rectifiers is described. *Modern Metals,* v. 16, no. 5, June 1960, p. 72.

11521 Development of Ferritic Steels for High Temperature Sodium Service. I. The commercially available ferritic chromium-molybdenum steels have several advantages over austenitic stainless steels. However, they have lower high-temperature strength, tend to decarburize in Na systems containing austenitic steels, and require post-weld heat treatments. The purpose is to develop a ferritic steel which has strength at 1100 F equal to Type 304 stainless steel, resists decarburization in Na systems, and does not require a complex post-weld heat treatment. In the alloy development program at Atomics International, Cb and Ti are added to conventional Cr-Mo high temperature steels. A 2.25% Cr-1% Mo-0.4% Cb-0.4% Ti analysis was produced and evaluated. ***W. C. Hayes and A. J. Birkle.*** *U. S. Atomic Energy Commission, NAA-SR-4832,* May 15, 1960, 33 pp. (UF767 Un3.1na Contin.)

METALS—CORROSION

11522 Kinetics of Nickel Corrosion in Sulfuric Acid. Nickel corrosion in sulfuric acid solutions at elevated temperatures and O over-pressures was investigated. Weight loss was linear with time and varied directly with O concentration. Independent variation of the possible active species in solution indicated that the undissociated sulfuric acid molecule plays an important part in the corrosion mechanism. ***Charles H. Pitt and Milton E. Wadsworth.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 3, June 1960, p. 395-401.

11523* The Corrosion of Fuel Elements in Water and Water Vapor. Describes means to obtain corrosion-resistant fuel elements. Now available as UO_2 or U-Mb or Nb-alloys canned with stainless steel or alloys based on Zr, Nb or Al. (*In German.*) Die Korrosion von Brennstoffelementen in Wasser und Wasserdampf. ***F. Janitschek.*** *Atomkernenergie,* v. 5, June 1960, p. 222-229.

11524 Cathodic Protection. Chemistry of underground and underwater corrosion; applications of active metals for sacrificial protection; construction of installations, etc.; practical guide for those working in the field. ***Lindsay M. Applegate.*** 229 pp. 1960. McGraw-Hill, New York. (TA462 Ap52c)

11525 Conditions of Cathodic Protection of Metals. Cathodic anticorrosive protection was examined from the thermodynamic and kinetic viewpoint. Diagrams were given for 43 metals and metalloids. For the function of the electrode voltage and of the pH at 25 C, the theoretical conditions of corrosion, passivation and cathodic protection were studied. Instances were given concerning the use of polarization curves in the case of cathodic protection of usual or stainless steel. (*In French.*) Conditions de protection cathodique des métaux. ***M. Pourbaix.*** *Centre Belge d'Etude de la Corrosion, Rapports Technique Nos.* 84-85, Apr. 1960, 9 pp. + graphs and figures. (TA462 C33r Vis.)

11526 High-Alloy Trays Last Three Times Longer. Use of a nickel alloy top tray of a special design in this crude fractionator helped Skelly Oil to eliminate spring turnaround, saving nearly half a million barrels of production. ***Gordon Weyermuller and G. C. Thrift.*** *Chemical Processing*, v. 23, July 1960, p. 53-54.

11527* Experiments on the Prevention of Pitting Attack on Cast Iron Propellers by Cathodic Protection-2. Suggests that a half-shrouded propeller anode can confer a very useful degree of protection against pitting attack on cast iron propellers provided that the rotating propeller shaft is not in good electrical contact with the hull. ***R. I. Higgins and H. H. Collins.*** *Corrosion Prevention & Control*, v. 7, May 1960, p. 41-48.

11528 Corrosion Behavior and Passivity of Nickel-Chromium and Cobalt-Chromium Alloys. Pure Ni-Cr alloys containing up to 29% Cr and Co-Cr alloys containing up to 23% Cr were prepared in vacuum. Corrosion rates in sulfuric and nitric acids, corrosion potentials, and critical current densities for passivity were determined at 25 C. Concludes that specific alloying proportions of passive compositions are better evaluated in relation to electron configuration of the alloy system by critical current densities than by potential or corrosion rate measurements. ***A. Paul Bond and H. H. Uhlig.*** *Electrochemical Society, Journal*, v. 107, June 1960, p. 488-493.

11529* Some Results of the Investigation of the Corrosion of Air Preheaters in a Flue Gas Medium. The region of maximum corrosion damage in air preheater pipes during layer combustion of anthracite AM is observed in the case of a surface temperature lower than the dew point at 35-45 C. The zone of low corrosion speed in the region of temperature lower than the dew point is small (at K = 0.2 min/year—it extends within the range of temperature t(H_2O) + 30 C ÷ 85 C) and its position varies. (*In Russian.*) Nekotorye rezul'taty issledovaniia korrozii vozdukhopodogrevateleĭ v srede dymovykh gazov. ***Iu. G. Dashkiev.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Energetika*, 1960, no. 4, Apr., p. 91-99.

11530* A Contribution to the Problem of Corrosion of a Soda-Arsenate Sulfur Purifier. Dependence of speed of corrosion of low carbon steel in soda arsenate solutions was determined from S/As and Na/As ratios. Speed of corrosion in these purifiers can be lowered considerably by increasing the concentration of the residual As in the scrubber solutions. (*In Russian.*) K voprosu o korrozii apparatury mysh'iakovo-sodovykh seroochistitel'nykh ustanovok. ***I. A. Levin and N. P. Kovalenko.*** *Khimicheskaia Promyshlennost'*, 1960, no. 1, Jan.-Feb., p. 74-76.

11531 High Temperature Corrosion Study Interim Report for the Period November 1958 Through May 1959. Samples of grade A Monel and grade A Ni were subjected statically in a single reactor to an undiluted atmosphere of gaseous fluorine at pressures up to one atmosphere absolute and temperatures up to 1500 F. Nickel was found to form a continuous, adherent fluoride film with an undiluted fluorine atmosphere at temperatures up to 1800 F. Grade A Ni samples coated with nickel fluoride films of 37,000 and 74,000 A., respectively, were exposed to an absolute pressure of gaseous uranium hexafluoride. Observations indicate that after passage of an initial period during which a relatively low corrosion rate in uranium hexafluoride at 1800 F is experienced, Ni is attacked at an accelerated rate with the resultant deposition of large quantities of uranium tetrafluoride. Thus the use of Ni to contain uranium hexafluoride or fluorine at 1800 F is not promising due to volatility and instability of nickel fluoride, intergranular attack of the metal, and proximity to the melting point of Ni, 2647 F. ***C. F. Hale, E. J. Barber, H. A. Bernhardt, and Karl E. Rapp.*** *U. S. Atomic Energy Commission, AECD-4292*, July 28, 1959, 38 pp. (UF767 Un3m Contin.)

11532 Corrosion of Beryllium in Flowing Sodium. Samples of seven types of fabricated Be were exposed to Na flowing at 20 ft/sec at 900 F for 47 hr followed by 520 hr at 1000 F. On completion of the test, all samples were found to be nitrided and some were joined together at points where the Be had been in contact with Be. Variation in behavior between the different samples was not apparent. The Be_3N_2 film was the thickest on the face exposed to high velocity Na being about 50 microns thick. The Be_3N_2 film was black, hard, and adherent. The Be below the surface film did not appear to be affected by exposure to Na. ***W. W. Kendall.*** *U. S. Atomic Energy Commission, GEAP-3333*, Jan. 15, 1960, 15 pp. + 12 figures. (UF767 Un3.1gea Contin.)

11533 Corrosion of Superalloys by Selected Fused Salts. The corrosion of Inconel X, Inconel 702, René 41, M-252, and Haynes 25 by potassium chloride and lithium fluoride at 1600 to 1900 F was studied. Thin coatings of the salts (1.5 mg/cm^2) caused severe corrosion of the alloys in air, which resulted in accelerated failures of thin sheet specimens in creep-rupture testing. The corrosion products consist of oxides and spinels. ***A. Moskowitz and L. Redmerski.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 60-115, Mar. 1960, 75 pp. (TL507 Un3.18w Vis.)

11534 Corrosion of the Zircaloy-2—Niobium Couple. A potential nuclear fuel element might consist of both Nb and Zircaloy-2. If the two metals were bonded together and exposed to a corrosive environment, galvanic corrosion might lead to an accelerated attack of either the Nb or Zircaloy-2. Objectives were to determine if galvanic corrosion exists under reactor conditions and to estimate the amount of damage that might occur. Mechanically coupled and uncoupled specimens of Zircaloy-2 and Nb were exposed for 49 days to 680 F static water to which LiOH was added to obtain a pH of 9.5±0.5. ***R. E. Campagnoni and M. A. Powers.*** *U. S. Atomic Energy Commission, KAPL-2079*, Mar. 14, 1960, 16 pp. (UF767 Un3.1ka Contin.)

11535 Diffusion Annealing as a Means of Improving Corrosion Resistance of Zircaloy-2 Clad, Uranium-2 w/o Zirconium Rods. The diffusion heat treatment technique was investigated as a means of improving corrosion protection provided by Zircaloy cladding coextruded with rods of U-2 w/o Zr alloy. In particular, all heat treatments from 800 to 1050 C greatly increased the corrosion life if the time at temperature was sufficient; slow cooling rates or subsequent heat treatments between 650 and 700 C were detrimental; a strong initial bond is desirable; the treatment does not reliably provide protection if the cladding is 10 mils thick or less. Tests were also performed on specimens with defects resulting from flaws placed in the cladding component prior to extrusion. Most of these specimens did not benefit from the diffusion anneal. ***R. G. Jenkins.*** *U. S. Atomic Energy Commission, NMI-1217*, Apr. 11, 1960, 70 pp. (UF767 Un3.1nm Contin.)

11536 Aqueous Corrosion of Thorium Alloys and Zircaloy-Clad Thorium Alloys. An investigation was made of the ability of thorium alloys extrusion-clad with Zircaloy-2 to survive catastrophic rupture when the core alloy was exposed to high temperature water through a small artificial defect in the cladding. At the same time the aqueous corrosion resistance of various thorium alloys was determined at a series of temperatures, and their activation energies were obtained. The attack of the core alloy through the defect in the clad appeared to progress, in part, preferentially along the clad-core interface. ***D. S. Kneppel.*** *U. S. Atomic Energy Commission, NMI-1226*, Mar. 22, 1960, 49 pp. (UF767 Un3.1nm Contin.)

11537 Corrosion of Zirconium Alloys in 900 and 1000°F Steam. Steam at 900 to 1000 F and 1500 psi is a very corrosive medium for Zr alloys. Zircaloy-2 and Zircaloy-3 fail after a short time under these conditions. The presence of Sn is highly detrimental to the corrosion resistance, while additions of Cr, Ni, and Fe, both singly and in combination, extend the life of Zr-base alloys at these temperatures. ***J. Paul Pemsler.*** *U. S. Atomic Energy Commission, NMI-1235*, Mar. 15, 1960, 25 pp. (UF767 Un3.1nm Contin.)

11538* Investigation of the Corrosion Resistance of the Solid Solution of Metals of the Fe-Ni-Cr System. In 5% H_2SO_4 and HCl solutions a limit of the corrosion resistance is observed when the alloy contains 18% Cr and 8% Ni. The appearance of this limit is confirmed also by a change in the potentials depending upon the composition of the alloy. This limit is explained by the nature of the γ-phase formed in the system. (*In Russian.*) Issledovanie korrozionnoĭ stoĭkosti tverdykh rastvorov metallov sistemy Fe-Ni-Cr. ***N. N. Grantsianskiĭ and P. F. Kaliuzhnaia.*** *Ukrainskĭ Khimicheskii Zhurnal*, v. 26, no. 3, 1960, p. 324-326.

11539* Kinetic Relations Between Accelerated and Natural Atmospheric Corrosion. On the strength of the kinetically determining combination of factors of atmospheric corrosion (over-critical humidity; SO_2 content up to 0.01%), an accelerated corrosion test was designed, the results of which are quantitatively related to the progress of corrosion in natural atmospheres. This was achieved by analyzing the corrosion-time curves of natural corrosion and accelerated corrosion of carbon steel (representing the ferrous metals) and Zn (representing the nonferrous metals). A method for the calculation of the acceleration coefficients applicable to the short-time test, and the determination of these coeffiicents was worked out. (*In German.*) Über kinetische Beziehungen zwischen beschleunigter und natürlicher atmosphärischer Korrosion. ***Karel Bartoň and Eduard Beránek.*** *Werkstoffe und Korrosion*, v. 11, June 1960, p. 348-351.

See also: **11884** (improving corrosion resistance of welds).

METALS—EXTRACTION AND REFINING

11540* Intensifying Open-Hearth Melting. Treating the metal in the ladle with 0.75 to 1.0% of a mixture consisting of 70 to 80% lime, 15 to 20% fluorspar and 5 to 10% ferrosilicon decreases the S content by 23 to 30% when 0.16 to 0.28% Si exists in the steel. Desulfurization in the ladle considerably decreases the melting time in the cases of elevated S contents in the metal during melting. (*In Russian.*) Intensifikatsiia martenovskoĭ plavki. ***A. K. Omarov and A. E. Khlebnikov.*** *Akademiia Nauk Uzbekskoĭ SSR, Izvestiia, Seriia Tekhnecheskikh Nauk*, 1960, no. 2, p. 15-20.

11541* Manufacture of Mechanically Capped Steel Ingots in Australia. The use of mechanical capping in producing rimmed steel restricts the rimming time and produces ingots with a thinner rim and less segregation. Manufacture of mechanically capped steel ingots poured in bottle-top moulds for production of tinplate is outlined. Discusses and compares two methods of manufacture. ***A. A. Corbett.*** *Australian Institute of Metals, Journal*, v. 5, no. 1, May 1960, p. 29-37.

11542* Physical Chemistry of Vacuum Treatment of Molten Metals. A discussion of factors influencing the state of a vacuum melt after a given time of treatment. ***R. G. Ward.*** *British Chemical Engineering*, v. 5, June 1960, p. 401-403.

11543 Preparation and Refining of Yttrium by Y-Mg Alloy Process. Yttrium metal was prepared by the reduction of YF_3 with calcium forming a low melting Y-Mg intermediate alloy. Magnesium was removed by sublimation to produce Y metal sponge. Describes a method for removing O and F from the alloy by extraction with fused Y salts. Presents results of electron beam melting and zone refining. ***O. N. Carlson, J. A. Haefling, F. A. Schmidt, and F. H. Spedding.*** *Electrochemical Society, Journal*, v. 107, June 1960, p. 540-545.

11544 The Thermodynamics of the Conversion of Magnesium and Manganese Oxides to Sulphides. The equilibria $MS+H_2O = MO+H_2S$, where M is Mg or Mn, were studied by a gas circulation method, the H_2S pressures being measured by the use of radio-sulfur. ***E. W. Dewing and F. D. Richardson.*** *Iron and Steel Institute, Journal*, v. 195, pt. 1, May 1960, p. 56-58.

11545 The Activity of Calcium Oxide in Slags in the Systems $CaO-MgO-SiO_2$, $CaO-Al_2O_3-SiO_2$, and $CaO-MgO-Al_2O_3-SiO_2$ at 1500°C. The sulfur equilibrium between $CO-CO_2-SO_2$ gas mixtures and slags in the systems $CaO-Al_2O_3-SiO_2$, $CaO-MgO-SiO_2$, and $CaO-MgO-Al_2O_3-SiO_2$ was studied at 1500 C. Results were used to assess the activity of lime in these slags. ***M. R. Kalyanram, T. G. Macfarlane, and H. B. Bell.*** *Iron and Steel Institute, Journal*, v. 195, pt. 1, May 1960, p. 58-64.

11546 Desulphurization of Molten Steel by Solid Lime During Vacuum Melting. Desulfurization of steel by solid lime in a 28-lb capacity vacuum furnace was investigated. A shell of lime applied to the conventional basic lining of the induction furnace rapidly removes sulfur from the molten steel and equilibrium is closely approached in about 20 min. at 1560 C. ***R. G. Ward and R. Hall.*** *Iron and Steel Institute, Journal*, v. 195, pt. 1, May 1960, p. 75-78.

11547 A Visual Method of Primary Slag Control for the Basic Electric-Arc Furnace. Solidified slags from the oxidizing period in the basic arc furnace are classified according to physical appearance. Characteristics are described in the hope that they may guide operators in assessment of basicity and percentage iron oxide. ***J. D. Sharp, W. Johnson, and K. W. Andrews.*** *Iron and Steel Institute, Journal*, v. 195, pt. 1, May 1960, p. 83-94.

11548* Relative Coefficients of Diffusion in Molten Slags. These coefficients were evaluated at 1460 and 1560 C according to the values of the specific currents of concentration polarization at the cathodic deposition of Fe, Mn, Co, Ni, V, Ti, Si, Nb, B, Zr, P, and Cr. They are close together in the case of V, Ti, Si, Nb, B, and Zr, but differ sharply from 6 to 7 times in the case of Fe, Mn, Co, and Ni. A theoretical explanation is given. (*In Russian.*) Ob otnositel'nykh koeffitsentakh diffuzii v rasplavlennykh shlakakh. ***V. I. Musikhin and O. A. Esin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, 1959, no. 12, p. 3-12.

11549* Chemical Heterogeneity of the Metal in Large-Scale Ingots of Semikilled Steels. In order to obtain a structure of semikilled ingot in the type of mold studied, it is enough to charge Al into the mold, for steels 08kp about 150 g/t and for steels 3kp about 50 g/t. Ingots, cast on lined bottom plates, have more uniform height-wise chemical composition and a concentrated volume of negative liquation of the lower half of the ingot. Using refractories for the lining of the flange of the bottom plate improves the metal. (*In Russian.*) Khimicheskaia neodnorodnost' metalla v krupnykh slitakh poluspokoĭnoĭ stali. ***V. I. Lapitskiĭ, K. P. Rudichev, N. I. Stupar', V. V. Oleksenko, and A. I. Marinov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, 1959, no. 12, p. 49-56 + 1 plate.

11550* Some Problems of the Kinetics and Mechanism of Ferric Oxide Reduction by Carbon. In the first stage of direct Fe_2O_3 reduction, the gas phase ($CO-CO_2$) plays a fundamental part and the emergence of metallic iron has a high effect on the kinetics of the $FeO_{min\ o} \rightarrow Fe$ stage. The speed of the current of neutral gas (N) through the space of reaction has a complex effect on the process of direct reduction of ferric oxide. Water vapors in low concentrations intensify the direct reduction of ferric oxide at moderate temperatures. (*In Russian.*) Nekotorye voprosy kinetiki i mekhanizma vosstanoveleniia okisi zheleza uglerodom. ***V. K. Simonov and S. T. Rostovtsev.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, 1960, no. 4, p. 5-18.

11551* Effects of the Blast Temperature of the Intensifiers and of the Injection of Fuels on the Oxidizing Zone of the Blast Furnace. The extent of the oxidizing zone is determined basically by the size of the circulation zone, that is by mechanical factors. The mechanism of the effects on the extension of the oxidizing zone of the temperature and dampness of the blast, of its O concentration, is more complex than thought before. Under definite conditions it depends on the combination of chemical, physico-mechanical and thermal factors and on the working of the furnace. (*In Russian.*) Vliianie temperatury dut'ia, intensifikatorov i vduvaniia goriuchikh veshchestv na okislitel'nuiu zonu domennoĭ pechi. ***V. I. Loginov.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, Chernaia Metallurgiia*, 1960, no. 4, p. 29-36.

11552* Investigation of the Kinetics and Mechanism of Oxidation of Mixture of Molten Iron Based on the Theory of Critical Concentrations. Each kinetic curve consists of two different sections expressing different relationships. Above crib-

cal concentration the velocity of the process obeys the laws of diffusion kinetics liimted by the flow of O from the contact zone. Below critical concentration the process develops in the diffusion region of reaction and is slowed down by the flow of O from the metal into the contact zone. Critical concentration marks the beginning of the slowing down of the oxidizing process. (*In Russian.*) Issledovanie kinetiki i mekhanizma okisleniia primeseĭ rasplavlennogo zheleza na osnove predstavleniĭ o kriticheskikh kontsentratsiiakh. ***Dun E. Filippov and S. I. Filippov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia,* 1960, no. 5, p. 28-38.

11553* A Contribution to the Study of the Heat Exchange in Shaft Furnaces. The connection found between the temperature of the blast furnace and that of the charge and theoretical heating temperature permits a solution of the equation of heat transfer and of thermal balance on one ton of cast iron. Thus a more accurate method for calculating the charge is obtained. (*In Russian.*) K voprosu teploobmena v shaktnykh pechakh. ***S. V. Shavrin and A. V. Chentsov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia,* 1960, no. 5, p. 172-176.

11554* Crystallization of Ingots by the Action of Vibration and Ultrasound on Molten Metal. Under casting and welding conditions, the breaking up of the grain in the ingot and welded seams occurs because of the modifying effect of fragments of the solid phase. These fragments are formed as a result of the breakdown, due to vibration and ultrasound, of the front crystals, either from the wall of the mold or from the edge of the welding bath. (*In Russian.*) O kristallizatsii otlivok pri deĭstvii vibratsii i ul'trazvuka na zhidkiĭ metall. ***G. F. Balandin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Mashinostroenie,* 1960, no. 6, p. 24-34.

11555 Pure Columbium and Tantalum Oxides by Liquid-Liquid Extraction. Complete separation of the metals Cb and Ta is achieved at the Albany, Ore., plant of Wah Chang Corp., by solvent extraction of the acid fluorides. The effect of acidity on the solubilities of two fluorides is the mechanism of their separation. ***Carl W. Carlson and Ralph H. Nielsen.*** *Journal of Metals,* v. 12, June 1960, p. 472-475.

11556 Basic Oxygen Steelmaking. Summary of developments taking place includes: history of the LD process, place of basic O steelmaking, physical chemistry of the process, summary of dust control procedures, and description of specific problems, processes, and plants. Both the LD and the Kaldo processes are included as well as such variations as the LD-AC process, and a new Canadian bottom-blowing process. No mention of the Oberhausen Rotor process, but with the recent start-up of operations in South Africa, perhaps new information will soon be available on this process. The first process to use O was the LD (Linz-Domawitz) method. It was developed in 1949 in Austria as the culmination of work beginning with mention of use of O in some of the Bessemer patents. Since that time, developments have moved at an ever faster pace in today's revolution in steelmaking. The LD process can now be used for the treatment of most types of hot metal, regardless of Si and P content. The conventional technique of blowing with atmospheric air is actually used and will still be used by many companies, since the quality of the steel produced is prefectly adapted to numerous applications and operating costs are the lowest under the economic conditions under which the producing plants operate. The tendency today is to use O-enriched air or O-steam mixtures, mainly because of the relative cost of pig iron and scrap and the necessity for some steel works to produce steels with high cold-ductility properties. For the conversion of high-P hot metal by top blowing the LD-Pompey or the LD-AC processes (use of O-powdered lime mixtures) are used; quality of the steel produced is equal to that of O-steam or open-hearth steels. The Kaldo process is extremely flexible for refining of different Fe types. This is true, not only with reference to the composition of the hot metal and the production program, but also in connection with the ability to adjust the process in accordance with the temporary price relations between Fe and scrap. More than 40% of the total metallic charge can consist of scrap, which is a very high proportion for a pneumatic process. Bottom blowing with O is a new Fe-refining process which drastically reduces iron oxide fumes. Instead of the top lancing of the LD process, high-pressure O is injected into the bottom of the metal bath through specially designed injectors. The cooling effect of the O flow itself eliminates the need for an external coolant. *Journal of Metals,* v. 12, July 1960, p. 515, 528-569.

11557* Contribution to the Melting of Reactive and High-Melting Point Metals and Alloys in the Vacuum Arc Furnace. Description of the process. Discusses influence of impurities, degassing and deoxidation, fusion electrodes and arc melting, economy of melting in the vacuum arc furnace. (*In German.*) Beitrag zum Schmelzen von reaktiven und hochschmelzenden Metallen und Legierungen im Vakuumlichtbogenofen. ***Hans Sabath.*** *Neue Hütte,* v. 5, Apr. 1960, p. 193-202.

11558* Current State of Development of All-Basically Lined Open-Hearth Furnaces in the German Democratic Republic. The state of development of all-basically lined open-hearth furnaces in Europe, the U.S.A. and the Soviet Union, refractory materials for all-basically lined open-hearth furnaces in the German Democratic Republic, results of durability of all-basically lined open-hearth furnaces, operating method and thermal production control, heating, cooling are discussed. (*In German.*) Über den Stand der Entwicklung ganzbasisch zugestellter Siemens-Martin-Ofen in der Deutschen Demokratischen Republik. ***Friedhold Rabes and Leo Ullsperger.*** *Neue Hütte,* v. 5, Apr. 1960, p. 218-232.

11559* Separation of Hafnium From Zirconium by Tributyl Phosphate Extraction. Zirconium oxide with Hf oxide content in the order of few hundredths per cent was obtained by extraction with tributyl phosphate in a laboratory scale multistage mixer-settler battery. Selection of diluent, behavior of circulating solvent, and possibilities of intensification of the process are discussed. (*In Polish.*) Rozdział hafnu od cyrkonu metoda ekstrakcji fosforanem trójbutylowym. ***T. Patzek.*** *Prace Instytutów Hutniczych,* 1960, no. 2, p. 93-100.

11560 Laboratory Evaluation of Crushed Crown Magnesium for Uranium Metal Production. "Crushed crown" Mg was evaluated on a small scale for possible use in U production. ***S. W. Weidman and R. F. Leifield.*** *U. S. Atomic Energy Commission, MCW-1443,* May 31, 1960, 25 pp. (UF767 Un3.1mc Contin.)

METALS—FINISHING, POLISHING, AND CLEANING

11561 Cleaning and Pre-Treating Aluminum Surfaces. Cleaning methods, vapor degreasing, alkaline cleaning solutions, phosphoric acid solutions, wash primers, anodizing, zinc chromate primer, improved types of lacquer, synthetic enamels, bituminous paints, luminous coatings are discussed. ***Lester F. Spencer.*** *Industrial Finishing,* v. 36, no. 8, June 1960, p. 60 + 6 pages.

11562* Surface Preparation of Metals. Methods of cleaning, solvents, solvent emulsions, electrolytic cleaning, ultrasonic cleaning, descaling are discussed. ***Lester F. Spencer.*** *Metal Finishing,* v. 58, June 1960, p. 53-58.

11563 Adherence of Thick Chromium Deposits as Affected by Surface Preparation. Photomicrographs show that honing, usually considered a relatively mild machining operation, can cause extensive damage to metal surfaces. Machining, grinding, even polishing, can also cause sufficient damage to metal surfaces to affect the bond strength of electrodeposits on these surfaces. Where electrodeposits are liable to severe stresses in service, it is especially important to remove these weakened surfaces before plating. ***J. G. Poor, H. Chessin, and C. L. Alderuccio.*** *Plating,* v. 47, July 1960, p. 811-813.

11564 Mechanical Burr Removal. The airless blast method and vibratory, barrel, and wet blast deburring are discussed. *Precision Metal Molding,* v. 18, July 1960, p. 53 + 3 pages.

METALS—FOUNDRY PRACTICE

11565* An Outline of British Diecasting Practice in Aluminium Alloys. Comparisons between the different trends

in the UK and the USA with regard to the use of the gravity- and pressure-die-casting processes. Notes the predominance of the pressure process in the USA and of the gravity method in the UK, and some of the underlying reasons for this are described. Modern methods of metallurgical and foundry control and future development trends are mentioned. ***R. R. Woodward and H. J. Proffitt.*** *British Foundryman*, v. 53, June 1960, p. 259-272.

11566* A Study of the Bonding Forces Between Bentonite and Silica Sand. Aims to learn whether adhesive forces between clay and refractory determine the bonding strength of sand-bentonite-water molds, or whether the strength of the bond depended upon cohesive forces of the clay bond. Results indicate that on fracture the bond is broken through the clay face and not through the silica/clay interface. ***S. Feliu, J. M. Navarro, and H. F. Taylor.*** *British Foundryman*, v. 53, June 1960, p. 273-277.

11567* Electric Melting in Mold Casting. Some of the general advantages in using electric furnaces are: heat without chemical effects on the metal, suitable for precision casting without foreign elements, less metal loss, inexpensive raw materials, exact quantitative and qualitative adaptation of the melting process to the production circuit, easy operation, high efficiency, reduction of price and of wastes. (*In French.*) La fusion electrique en fonderie de moulage. ***Maurice Decrop.*** *Fonderie*, no. 172, May 1960, p. 175-188.

11568 New Foundry Makes Large Steel Castings. Steel castings of 65,000 lb are being poured at this new foundry. Molten metal is supplied by a basic-lined, electric arc furnace of 100-ton holding capacity, equipped with an induction stirrer. ***Robert H. Herrmann, editor.*** *Foundry*, v. 88, July 1960, p. 72-75.

11569 Casting in Zircon Sand Shell Molds. Carbon and low alloy steel castings up to 300 lb are produced in resin-bonded zircon sand molds. This former green sand job shop now has high production work capacity of 1800 tons a month. ***Robert H. Herrmann, editor.*** *Foundry*, v. 88, July 1960, p. 81-85.

11570 Gating Steel Castings. II. Discusses metal cleaning devices and factors which determine size, shape and placement of gates. ***Charles W. Briggs.*** *Foundry*, v. 88, July 1960, p. 86-91.

11571 Gating and Feeding of Small Steel Castings. Illustrates a wide variety of methods of gating and feeding employed in the foundry. ***A. Pearson.*** *Foundry Trade Journal*, v. 108, June 23, 1960, p. 779-786.

11572* Solidification Control of Ingot Feed Heads by Exothermic Powders and Sleeves. A new production method of shaped bricks was elaborated; these contain insulating and exothermic additions bonded with plastics. These shaped bricks can be produced in various designs; they have excellent strength and make it possible to pour smaller ingots with the theoretical volume of liquid steel in the hot top; in the case of ingots of 650 kg weight, the weight of the feed head was reduced under 0.5% of the ingot weight. (*In Czech.*) Ovlivňování tuhnutí ztracených hlav ingotů exotermickými zásypy a obklady. ***Lubomír Šmrha and Ivo Brodský.*** *Hutnické Listy*, v. 15, no. 4, Apr. 1960, p. 266-275.

11573 Recovery of Metal From Magnesium Alloy Foundry Residues by Centrifuging. Outlines the development of a horizontal centrifuge. This separates the metal from the flux fraction of the residue while both metal and flux are still molten. The metal thus separated can be remelted in the next melt of the same type without danger of contamination. ***H. J. Simcox, S. B. Hirst, and A. Young.*** *Institute of Metals, Journal*, v. 88, pt. 9, May 1960, p. 394-397.

11574* Cupola Furnace Operation With Partial Elimination of Gases Through the Hearth Into the Forehearth. The theoretical bases of the overheating method applied to cast iron in the cupola furnace during the combustion of coke in the low part of the bed charge were examined. For a cupola furnace with a 3 tons per hour output, overheating can be obtained up to 1450 to 1460 C, then gas saturation of cast iron and loss of admixtures do not increase. (*In Russian.*) Rabota vagranki s chastichnym otvodom gazov cherez gorn v kopil'nik. ***L. M. Marienbakh, Iu. S. Sukharchuk, and Ia. I. Oberman.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Mashinostroenie*, 1959, no. 12, p. 121-129.

11575* Automatic Stabilization of the Dampness of Molding Sand Mixture During Its Preparation. Description of a new method for the control of the dampness of molding sand, based on the measurement of the dielectric constant of the mixture depending on the moisture content. The method proved useful for automatic control in mass production. (*In Russian.*) Avtomaticheskaia stabilizatsiia vlazhnosti formovochnoĭ smesi v protesse ee prigotovleniia. ***E. I. Ushkalova.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Mashinostroenie*, 1960, no. 6, p. 119-127.

11576 Die-Castings in Data Processing. II. Discusses die-castings of a smaller and more complex type in zinc alloys. *Metal Industry*, v. 96, June 10, 1960, p. 483-484.

11577* Gap Formation in Permanent Mold Castings. Since gap formation is an important factor in the solidification of metals in permanent molds, one must clearly understand its mechanism before an analysis of the freezing process can take place. Presents the results of a literature survey to determine what is known to date about the mechanism of gap formation in permanent molds. ***J. G. Henzel, Jr. and J. Keverian.*** *Modern Castings*, v. 38, July 1960, p. 87-93.

11578* Epoxy Resin for Foundry Pattern. The technology of making molds of plaster of Paris, epoxy resins, method of preparing mixes for pouring patterns, methods of finishing, repair, and of fixing patterns on plates are discussed. Economics of applying patterns of epoxy resins and safety and hygiene requirements are given. (*In Polish.*) Żywica epoksydowa w modelarstwie odlewniczym. ***Henryk Wąsowicz.*** *Przeglad Odlewnictwa*, v. 10, no. 5, May 1960, p. 137-143.

11579 Beryllium-Clad Uranium Elements. Fabrication Development by Multi-Temperature Extrusion, and Dimensional Stability on Thermal Cycling. Describes some development studies concerning the co-extrusion of Be with either U or U having small alloy additions. Some test data on the general integrity of extruded rods is reported. ***J. Greenspan.*** *U. S. Atomic Energy Commission, NMI-1219*, Mar. 18, 1960, 41 pp. (UF767 Un3.1nm Contin.)

METALS—HEAT TREATMENT

11580* Growth of Graphitization Steel During Cyclic Heat Treatment. Studies the microscopic picture of the growth of graphitization steel. It was found that the increase in steel volume during cyclic heat treatment depends upon the accumulation of voids as a result of multiple graphite solution and separation. These voids are similar to the diffusion pores arising in systems composed of components greatly differing in the partial coefficients of diffusion. (*In Ukrainian.*) Rist grafityzovanoyi stali pid chas tsyklichnoyi obrobky. ***K. P. Bunin, A. A. Baranov, and M. I. Pritomanova.*** *Akademiia Nauk Ukrains'koĭ RSR, Dopovidi*, 1960, no. 6, p. 776-779.

11581* Study of the Processes Occurring During the Annealing of Plastically Deformed Copper. A special highly sensitive dilatometric method was used in studying the change in volume occurring during the annealing of Cu deformed by buckling at a room temperature up to different stages of deformation. The relative volume changes equal $3 \cdot 10^{-4}$ at the maximum stages of deformation, due to the disappearance during annealing of vacancies and dislocations in the deformed metal. (*In Russian.*) Izuchenie protsessov, proiskhodiashchikh pri otzhige plasticheski deformirovannoĭ medi. ***S. D. Gertsriken and N. N. Novikov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika*, 1960, no. 2, p. 37-43.

11582* Thermal Treatment and Mechanical Properties of Titanium Alloys With 5 to 13% Al. Annealed Ti alloys with over 7% Al have poor plastic properties. Alloys with over 9 to 10% Al exhibit brittleness when tested for expansion. Quenching in water from 700 to 1100 C can improve the plastic properties of alloys with 8 to 11% Al. Alloys with 11% Al are improved by 1000 to 1200 C quenching temperatures. Alloys with 12 and 13% Al remain brittle. (*In Russian.*) Termicheskaia obrabotka i mekhanicheskie svoĭstva titanovykh splavov s 5-13% Al. ***V. N. Moiseev.*** *Metallovedenie i Termicheskaia Obrabotka Metallov*, 1960, no. 6, June, p. 30-39.

11583 Isothermal Heat Treatment. Investigations show that: the higher the austenitizing temperature, the greater is the tendency for structure of the annealed steel to be lamellar; to develop the softest condition in steel, austenitize at a temperature usually less than 100 F over the critical, and transform at a temperature usually less than 100 F below the critical; after the steel has been austenized, cool as rapidly as feasible to the transformation temperature in order to decrease the total time of the annealing operation. ***Lester F. Spencer.*** *Metal Treating*, v. 11, no. 3, June-July 1960, p. 5 + 11 pages.

11584* Cast Iron Heat Treatment. Various types of heat treatments which are in use at the author's company. Discusses stress relieving, higher-temperature stress relieving, low temperature annealing, high-temperature annealing, normalizing and quenching in oil, tempering, and both gray and ductile Fe. ***P. H. Dirom, Jr.*** *Modern Castings*, v. 38, July 1960, p. 94-100.

11585* The Annealing of White Heart Malleable Cast Iron in Gaseous Atmospheres. Presents results of tests of annealing white heart malleable cast iron in a gaseous mixture created by incomplete burning of natural gas. In the investigations the best compositions of the gaseous mixture, which promoted a good decarburization of the castings, were determined. In relation to the casting wall thickness suitable annealing cycles were established. (*In Polish.*) Wyzarzanie białego żeliwa ciągliwego w atomosferach gazowych. ***Jan Roczka and Janusz Rutkowski.*** *Prace Instytutu Odlewnictwa*, v. 9, nos. 3-4, 1960, p. 229-255.

11586 Heat Treating High Hardness, Hot Work Tool Steel. A new hot-hardness tool steel die makes three times as many brass die castings as does a 9% tungsten steel. *Precision Metal Molding*, v. 18, July 1960, p. 41.

11587* On the Thermodynamics of the Decarburisation of Molten Uranium. In the fabrication of fissile elements of U with Zr canning, even small amounts of C in the U are sufficient to impair the properties of the metallic bond between U and Zr. The three most obvious methods of removing C, i.e., oxidation to CO, combination with efficient carbide-forming agents, and hydrogenation to CH_4, are shown not to be feasible in practice. Therefore U of very low C content must be selected from the outset for this application. ***Rolf H. Weisser.*** *Sulzer Technical Review*, v. 41, no. 3, 1959, p. 27-32.

See also: **11535** (diffusion annealing of Zr-U fuel elements).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

11588* Mechanical Properties of Steel SAE-5135 Tempered an Annealed, With More Than One Microconstituent. According to the type of thermal treatment applied, very different mechanical properties can be obtained for a steel of a determined hardness. The behavior of the material in this case can be used instead of metallographic examination. Incorrect thermal treatment produces impact resistance below normal. With correct treatment, for the same degree of tempering, the ratio between impact resistance and hardness is approximately linear. (*In Portuguese.*) Propriedades mecânicas de aço SAE-5135 temperado e revenido com mais de um microconstituinte. ***Tibério Cescon.*** *ABM (Boletim da Associaçao Brasileira de Metais)*, v. 16, no. 59, Apr. 1960, p. 359-374.

11589 Refractory Materials. II. High-Temperature Behavior. Part I discussed the general technology of refractory materials, their stability. Part II discusses their mechanical behavior at elevated temperatures and the physical properties important in controlling thermal stresses developed in structural applications. Future trends for these materials are also suggested. ***Robert I. Jaffee and Daniel J. Maykuth.*** *Aero/Space Engineering*, v. 19, July 1960, p. 39-44.

11590* Complex Stress Creep Fracture of an Aluminium Alloy. Examines the tertiary creep and the creep-fracture characteristics of an aluminum alloy of specification B.S.2L42, subject to complex stressing at 200 C. The scope of the work involved seven pure torsion, pure tension, and combined tension and torsion creep tests and analysis of the results. ***A. E. Johnson, J. Henderson, and V. D. Mathur.*** *Aircraft Engineering*, v. 32, June 1960, p. 161-170.

11591* The Influence of the Relation Fe/Si on Electrical and Tensile Characteristics of Al. The relation Fe/Si on electrical and mechanical characteristics of Al containing lowest quantities of secondary impurities, varying the % of Si and Fe, was studied. From the results obtained it appears that, with low quantities of Si and other impurities in Al for electrical uses today produced, it is not necessary that the ratio Fe/Si be maintained within the limits 1,3-1,7 prescribed by UNI 3950. (*In Italian.*) Influenza del rapporto Fe/Si sulle caratteristiche elettriche e tensili dell'alluminio. ***C. Panseri, M. Leoni, and G. Tombazzi.*** *Alluminio*, v. 29, no. 5, May 1960, p. 231-239.

11592 Mechanical Properties of Magnesium Monocrystals. Using critical shear stress and creep data, activation energies for creep at low and at high temperatures are derived. The activation energy at low temperatures is the same as that for jog formation and the activation energy at high temperatures agrees with that for climb. ***W. F. Sheely and R. R. Nash.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 416-423.

11593 Microstrain in Zinc Single Crystals. The stress-strain behavior of Zn single crystals was measured over a strain range of 10^{-6} to 10^{-2}. The phenomenon of macroyielding was observed in detail and plastic strains were detected at almost zero-stress. From the hysteresis a frictional stress on the dislocation of about 6 psi was obtained. A preliminary analysis indicates that impurities are primarily responsible for the friction. ***J. M. Roberts and N. Brown.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 454-463.

11594 Deformation and Fracture of Magnesium Bicrystals. A series of variously oriented bicrystals of Mg having a vertical grain boundary were prepared and tested in tension. It was found that piled-up arrays of dislocations at the grain boundary could, under appropriate conditions, induce slip, twinning and cracking. ***J. D. Mote and J. E. Dorn.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 491-497.

11595 Use of Axis Distribution Charts to Represent Sheet Textures. The use of axis charts for representing the texture of cold-rolled Th sheet was compared with conventional pole figures. Four texture components were deduced from the axis charts and shown to be consistent with the pole figures. Shows that consideration of the pole figures alone could lead to an apparent component which is the average of two actually present. ***C. J. McHargue and L. K. Jetter.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 550-553.

11596 Room-Temperature Recovery of Internal Friction and Elastic Constants in Freshly Quenched Steels. An experimental study was made of the time dependence of internal friction and modulus of rigidity in freshly quenched steels at room temperature. The effects of frequency, composition, and various thermal treatments are given. ***C. E. Beaulieu, A. Dubé, and G. Letendre.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 558-566.

11597* Developments in the Production of Notch Ductile Steels. Presents methods adopted at the works of Australian Iron and Steel Pty. Ltd. at Kembla, for the production of semi-killed, notch-ductile mild steel plates. Experimental work related to the development of a fully-killed, high-tensile weldable grade is discussed. ***J. K. MacDonald.*** *Australian Institute of Metals, Journal*, v. 5, no. 1, May 1960, p. 52-62.

11598* Changes in Physical Properties and Microstructure of Metals Due to Rapid Straining. Describes a series of tests performed to determine the comparative effects which dynamic and static straining, in compression, have on the physical strength properties of mild steel and an aluminum alloy. Dynamic deformation considerably modifies the rate of strain hardening. ***J. Duby.*** *Canadian Mining and Metallurgical Bulletin*, v. 53, no. 578, June 1960, p. 409-418.

11599* Effects of Temperature and Duration of Stress on the Relationship Between Hardness and Composition of Dilute Solid Solutions. At different temperatures and with different stress durations—that is, different average velocity of deformation—the hardness of dilute solid solutions of Hg in Cd, Pb and Sn; of Sb in Sn and Pb; of Ag in Cd; of Bi and Cd in Pb; of Sn in Pb; of Na in Pb; and of Zn in Bi and Cu was tested. In the case of high solubility of one metal into the other (20 at.% and more) in the region of the solid solution, a maximum of hardness is observed. (*In Russian.*) Vliianie temperatury i prodolzhitel'nosti nagruzki na sootnosheniia mezhdu tverdost'iu i sostavom razbavlennykh tverdykh rastvorov. ***V. P. Shisbokin and A. E. Nikerov.*** *Fizika Metallov i Metallovedenie*, v. 9, no. 5, May 1960, p. 768-777.

11600* Influence of Aluminum on the Mechanical Properties of Unalloyed Cast Steel. Tests were carried out on five charges from basic arc furnace and from acid high frequency furnace, the Al content of which has been increased during casting. The plastic properties (ductility, contraction, notch toughness) and the real rupture strength of all the charges decreased with the increased content of Al soluble in acid. The yield point and tensile strength did not change. At higher content of Al soluble in acid mussel-fractures always appeared. (*In Czech.*) Vliv hliníku na mechanické hodnoty nelegované oceli. ***Přemysl Fremunt.*** *Hutnické Listy*, v. 15, no. 6, June 1960, p. 447-450.

11601 Fatigue-Induced After-Effect in Zinc Single Crystals. Negative strain rates are known to occur on unloading in creep experiments on polycrystalline metal specimens. Previous attempts to reproduce this "after-effect" in single crystals have failed. Results now reported show that the after-effect can occur in Zn single crystals if a fatigue stress is superimposed. ***A. H. Meleka and G. B. Dunn.*** *Institute of Metals, Journal*, v. 88, pt. 9, May 1960, p. 407-410.

11602 The Dependence of Creep Behaviour on the Duration of a Superimposed Fatigue Stress. The superposition of a fatigue stress in a creep experiment results in a sudden increase in the creep rate, which decreases with time, the strain following a (time)2/3 law. If the fatigue stress is removed, it is observed that the resulting creep rate is even less than the original static rate. This hardening also follows the (time)2/3 law. ***A. H. Meleka and A. V. Eversbed.*** *Institute of Metals, Journal*, v. 88, pt. 9, May 1960, p. 411-414.

11603 The Influence of Non-Metallic Inclusions on the Fatigue Properties of Ultra-High-Tensile Steels. The relationship between nonmetallic inclusions and the fatigue properties of steels heat-treated to about 125 tons/in^2 tensile strength was investigated. A theory for the influence of inclusions was developed and a new counting technique devised to comply with this theory. ***M. Atkinson.*** *Iron and Steel Institute, Journal*, v. 195, pt. 1, May 1960, p. 64-75.

11604* Effects of the Composition, Austenizing Conditions and Cooling Method on the Formation of Cracks in Steel. Cracks are formed by tensile stresses appearing during cooling of rolled Fe and forged pieces. Tensile stresses and lowered plasticity of decomposition products of undercooled austenite of steel supersaturated by H are the fundamental causes of crack formation in steel. The nonuniform and high concentration of H in steel and the decomposition of undercooling austenite within the range of martensitic transformation increase the susceptibility to cracks. (*In Russian.*) Vliianie sostava, rezhima austenizatsii i sposoba okhlazhdeniia na obrazovanie flokenov v stali. ***E. S. Tovpenets.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Chernaia Metallurgiia*, 1959, no. 12, p. 131-137 + 1 plate.

11605* Effects of Phosphorus and Manganese on the Surface Tension of Iron-Carbon Alloys. The effects of P are decreased by a rise of the C concentration simultaneously with a decrease of the O concentration. P adsorption is accompanied by the formation of some phosphorus oxide complexes in the surface layer. Manganese, on the one hand, combines P and C in the melt (up to 0.3 - 0.5% Mn) with a sharp increase of the surface tension. On the other hand, Mn can be adsorbed on the surface, in case of Mn concentrations above 0.3-0.4%, with a slight decrease of the surface tension. (*In Russian.*) Vliianie fosfora i margantsa na poverkhnostnoe natiazhenie zhelezouglerodistykh splavov. ***V. P. Grigor'ev, A. F. Vishkarev, B. G. Korolev, E. V. Abrosimov, and V. I. Iavoiskii.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Chernaia Metallurgiia*, 1960, no. 4, p. 55-65.

11606* Temperature Dependence of the Thermal Capacity of Some Copper-Based Solid-Solution Alloys. An apparatus was developed for the determination of thermal capacity at different temperatures. The Cu tested was alloyed with Ni (5 and 10%, Al (5.10 and 15.9%) and Zn (5%). In the Cu + 15.9% Al, anomalies were observed connected with the presence of a superstructure. (*In Russian.*) Temperaturnaia zavisimost' teploemkosti nekotorykh splavov tverdykh rastvorov na osnove medi. ***V. E. Panin, S. A. Gribanov, and K. K. Ziling.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Fizika*, 1960, no. 2, p. 121-126.

11607 Electron Probe Measurements of Evaporated Metal Films. Calibration curves of X-ray intensity vs. specimen thickness were prepared for the electron probe microanalyzer by using evaporated films of Cr, Mn, Zn, and Au in the 0-5000 Å range. For each element, the X-ray intensity increased almost linearly with thickness; for a given thickness, the X-ray intensity increased (but not linearly) with atomic number. Using previously published data on electron excitation efficiency to calculate expected X-ray intensities, the measured values from Cr, Mn, and Au were about 0.75 to 0.85 times the calculated value whereas Zn was about 1.25 times the calculated value. The variations are thought to result from some undetermined parameter such as density or internal strain. ***W. E. Sweeney, Jr., R. E. Seebold, and L. S. Birks.*** *Journal of Applied Physics*, v. 31, June 1960, p. 1061-1064.

11608* Stress Criterion for Fatigue Fracture of Steels. Presents approach to problem of correlating the macroscopic fatigue strength of steels with microscopic explanations of present dislocation theory. The stress concentration or notch effect due to the obstacle itself against which the dislocations pile up is taken into account in addition to assuming that stress concentration at the piled-up dislocations plays an important role in fatigue fracture of steels. ***T. Yokobori.*** *Journal of the Mechanics and Physics of Solids*, v. 8, no. 2, May 1960, p. 81-86.

11609 The Electrical Resistivity of Stacking Faults. The scattering of electrons and X-rays by stacking faults is due to a phase change in the diffraction by crystal planes which do not lie parallel to the fault. A wave matching calculation in which Tamm surface waves are used confirms the order of magnitude of the effect and is also in agreement with the prediction of the simple model that the distance over which scattering from two faults could interfere is less than the lattice spacing. ***A. Howie.*** *Philosophical Magazine*, v. 5, ser. 8, Mar. 1960, p. 251-271.

11610 Experimental Fusion Curves of Indium and Tin to 105,000 Atmospheres. The melting point was detected at various pressures by means of a sharp increase in the electrical resistance of the sample, which gave rise to a sudden increase in the sample temperature. The melting temperature of In was found to rise smoothly from a normal value of 156 C to a value of 417 C at 105,000 atm. No evidence of polymorphism is observed. A phase transition is found for Sn, with a triple point on the fusion curve at 38,000 atm, 318 C. ***J. Duane Dudley and H. Tracy Hall.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1211-1216.

11611 Irreversibility in the Superconducting Transition of Lead. The nature and origins of the hysteresis in the magnetic transition of pure superconducting Pb were studied. The effect can be introduced in nonhysteretic specimens by plastic deformation at liquid He temperatures. The hysteresis becomes apparent somewhat below T_c and its width increases monotonically with decreasing temperature. Similar effects can be caused by dilute additions of Ca to Pb. The residual superconductivity at high fields is increased by plastic deformation, and in general seems closely related to the hysteresis effect. ***R. W. Shaw and D. E. Mapother.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1474-1484.

11612 Magnetic Susceptibility of Metallic Europium. Susceptibility was measured from 1.3 to 300 K in fields up to 12,000 oersteds. This metal is found not to be ferromagetic, but to have at low temperatures a very high paramagnetic susceptibility, about forty times higher than for the free ion of hydrated salts. ***R. M. Bozorth and J. H. Van Vleck.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1493-1498.

11613 Elastic Constants of Palladium From 4.2-300°K. Measurements were made on a single crystals. ***J. A. Rayne.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1545-1549.

11614* Influence of Small Additions of Cobalt in Steels. Review of the physical metallurgy of Fe-Co alloys. Study of the effect of a small Co content on a rimming mild steel, on lightly alloyed steels, and on medium-alloy 13% Cr steels; the addition of several tenths of 1% of Co strongly affect both hot and cold ductility. (*In French.*) L'incidence de faibles additions de cobalt dans les aciers. ***L. Habraken.*** *Revue de Métallurgie*, v. 57, May 1960, p. 445-450.

11615 Elastic Limit by the Residual Strain Method Using SR4 and Tuckerman Gages on Aluminum Alloy. The "elastic limit" of 7075-T6 aluminum alloy was defined in terms of SR4 and Tuckerman gage indications through the use of residual microstrains following tensile and compressive loading and unloading. Residual strain vs. applied load relationships are developed as functions of reference stress level and material and gage history. ***Alton W. Brisbane and R. F. Klinger.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Note* 59-340, Mar. 1960, 32 pp. (TL507 Un3.18t Contin.)

11616 Mechanical Properties of Selected Alloys at Elevated Temperatures. Six materials in plate and bar form were subjected to tension, compression, bearing, and shear stresses at various temperatures after exposure times of ½, 10, 100, and 1000 hours at selected test temperatures. The materials studied were: AM355, PH15-7Mo, HK31-H24, A-286, Udimet 500, Inconel X. The temperature was in the range of 600 F to 1700 F. In general, test results show that most of the material properties regardless of the type of stress imposed decrease with temperature and time. Time of exposure was not as effective in lowering the properties as the temperature. ***Harry A. Pearl, George F. Kappelt, and Edmund J. King.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-702, Mar. 1960, 250 pp. (TL507 Un3.18w Vis.)

11617 The Thermal Expansion of Plutonium Metal Below 300°K. Curves for linear expansion of Pu metal as a function of temperature below 300 K are shown for different cooling and heating cycles and for different purity. Hysteresis and time effects were found to be appreciable. The linear expansion curve obtained with very slow cooling or very slow warming rates appears to confirm the presence of two of the three major heat capacity peaks found in the temperature range below 160 K. ***T. A. Sandenaw.*** *U. S. Atomic Energy Commission, LA*-2394, May 26, 1960, 23 pp. (UF767 U3La Contin.)

11618 Properties of Titanium-Vanadium-Cobalt Alloys. In general, the transformation of β to α began after only half an hour at aging temperatures of 450 and 500 C. There was some response to aging at 450 C for ternary alloys containing 12 to 20% of combined V and Co, but the hardness peak was followed by a continuation of softening. None of the alloys studied were stable with respect to complete β retention. Titanium-V-Co alloys solution-treated at 700 C followed by aging 4 hr. at 500 C were characterized by moderate strength and elongation. ***J. D. Ramsdell and E. D. Hull.*** *U. S. Bureau of Mines Report of Investigations* 5591, 1960, 13 pp. (TN21 Un3r Room 290)

11619 Higher-Strength Steels for Welded Structures. Considerable gains in tensile strength can be obtained by the use of low-alloy compositions, particularly in heavier sections. Fatigue resistance increases roughly as the tensile strength and does not appear to be a limiting factor in the use of the steels. Accelerated cooling can be used to raise the strength and notch ductility of steels. ***Robert D. Stout.*** *Welding Journal*, v. 39, July 1960, p. 273s-283s.

See also: **11582** (mechanical properties of Ti-Al alloys); **11656** (red hardness of cast high-W high-speed steel); **11749** (dimensional instability of U); **11899** (explosion-bulge tests of armor weldments); **11900** (notch-rutpure strength of stainless steel welds).

METALS—MECHANICAL WORKING

11620 Comparative Experiments in Drawing, Rolling, and Extruding of Bars Through a Pair of Cylindrical Rollers. Square bars of cold-drawn Cu, mild steel and a 2024 aluminum alloy were forced through an adjustable gap between two hardened steel rollers by pulling or pushing. The rollers were either free to rotate or were locked in position so that conditions comparable with drawing, rolling, and containerless extrusion could be created at will. ***N. H. Polakowski and L. B. Schmitt.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 409-416.

11621* Operating Conditions and Limits in Cold Strip Rolling. Discusses conditions governing the size and shape of the product from a cold strip mill. Shows that the size can be determined by the simultaneous solution of three equations. Typical solutions are determined and their use as a basis of gauge control discussed. The limits on pass reduction are shown. ***J. S. Hoggart.*** *Australian Institute of Metals, Journal*, v. 5, no. 1, May 1960, p. 1-11.

11622* The Assessment of the Drawability of Sheet Metal. Considers the various factors involved in a deep drawing operation and discusses the relevance of the numerous tests which may be applied to sheet metal for assessment of its suitability for use in deep drawing operations. ***N. G. Fraser.*** *Australian Institute of Metals, Journal*, v. 5, no. 1, May 1960, p. 12-22.

11623* Aluminium-Killed Deep-Drawing Steel Sheet. The factors giving rise to aging in low-carbon steel used in deep drawing are outlined and the advantages of using V-treated or Al-killed steels indicated. Aluminium-killed steel possesses special advantages in deep drawing which are enhanced if a "pancake" grain structure is developed. ***A. Snedden.*** *Australian Institute of Metals, Journal*, v. 5, no. 1, May 1960, p. 23-28.

11624 Flat Rolled Products. II. Semi-Finished and Finished. Hot machine scarfing of semifinished carbon steels; selection of ingot and slab sizes for the modern strip mill; observations on the scale structures of mild steel strip, temper rolling, unitized automobiles, processing and properties of magnetic materials. ***E. W. Earhart and R. D. Hindson, editors.*** v. VI. 150 pp. 1960. Interscience Publishers, New York. (TS340 Am35.5fr)

11625* Automatic Control of Soaking Furnaces. The actual state of automatic control of thermal régime of soaking furnaces is criticized and requirements in prospect on the improvement of the control system are given. Further types of automatic control are compared: ZPA (Works of Industrial Automation, Czechoslovakia), Siemens, Siamco and the latest type Siemens with apparatuses of Teleperm type. (*In Czech.*) Automatická regulace hlubinných pecí. ***Miloslav Gottwald.*** *Hutnické Listy*, v. 15, no. 6, June 1960, p. 429-432.

11626* Turret Lathe Contouring of Parts for Rocket Engines. Aluminum extrusions and forgings contour-turned and bored on turret lathes with hydraulic tracers. Requirements for low-volume production facilities for prepackaged, liquid-propellant, rocket-thrust units included rapid delivery and economy of equipment to provide machine versatility and to permit fast retooling for handling different parts. ***Charles H. Wick.*** *Machinery (New York)*, v. 66, no. 11, July 1960, p. 116-122.

11627 Steel and Specialty Alloy Extrusions. An extruded shape means a continous bar, with the same contour the whole length of the bar. Greater savings are possible with extruded shapes made of steel. *Precision Metal Molding*, v. 18, July 1960, p. 42-43.

11628 Photosensitive Glass + Chemical Machining. Where the pattern allows light to strike this special glass it becomes extra-soluble in etching acids—an economical way to turn out electrical and mechanical precision parts. ***Nicholas Lazar.*** *Product Engineering*, v. 31, no. 28, July 11, 1960, p. 66-70.

11629* Investigation of the Scales Formed on Sheets During Hot Rolling. The general characteristics of the scales formed on sheets of mild steel of three grades hot rolled in four different works were studied. By microexamination of polished sections, one can measure the thickness of the oxide, determine its constitution, and estimate its compactness, the adhesion of the oxide layer and the form of the metal-oxide interface. (*In French.*) Étude de la calamine formeé sur des feuillards au

cours du laminage a chaud. ***M. Cagnet and J. Moreau.*** *Revue de Métallurgie*, v. 57, May 1960, p. 437-444.

11630* High-Energy Forming Methods—A Critical Review. Drop-hammer, explosive, creep and ultrasonic forming methods are described and evaluated for various production applications. ***William W. Wood.*** *Tool Engineer*, v. 44, no. 7, June 1960, p. 93-105.

11631* Calculating Grinding Wheel Wear and Production. Grinding is subject to many variables—these are taken into account in a series of new nomographs. ***S. R. Uniechowski.*** *Tool Engineer*, v. 44, no. 7, June 1960, p. 113-119.

11632* Laminating Process Simplifies Tooling. Building a plastics laminate to be a self-restraining unit minimizes tooling required to fabricate a large plastics part. As the resin cures, atmospheric pressure supplies the restraining force. Thus large pressure-applying tools are not needed for fabrication. ***Benjamin Sokol.*** *Tool Engineer*, v. 45, no. 1, July 1960, p. 39-42.

11633* Putting Gun Reaming to Work. Multiple-flute gun reamers have passed the stage of laboratory development and are being successfully applied in many plants. They produce smooth, accurate holes at high production rates. ***Herbert Gregg.*** *Tool Engineer*, v. 45, no. 1, July 1960, p. 47-49.

11634* Determining Thread Quality by Differential Gaging. With a simple setup, the accuracy of screw threads can be quickly checked. Methods described are used to make sure that threads conform to the rigid specifications established by the Federal government for Space-Age applications. ***Russell V. Johnson.*** *Tool Engineer*, v. 45, no. 1, July 1960, p. 66-69.

11635* Feeding a Rotary Swager. There are three prominent feeder concepts: (1) a rotating collet whose rotation is controlled by a brake and the entire mechanism fed to the swager by a hydraulic cylinder; (2) the use of a traveling vise to hold and feed the work; and (3) roll feeds where straight-through swaging is required on long work. This last method can accomodate either solid or tubular work. ***Keith Bernhardt.*** *Tooling & Production*, v. 26, no. 4, July 1960, p. 49-51.

11636 Multi-Temperature Extrusions. Multitemperature techniques for achieving uniform plastic flow during extrusion of a composite billet were investigated. Efforts to produce successful co-extrusions of U clad with stainless steel and Mg, and of uranium dioxide clad with stainless steel and Mo are described. ***E. S. Guidoboni, I. B. Roll, and P. Loewenstein.*** *U. S. Atomic Energy Commission, NMI*-1229, Mar. 14, 1960, 49 pp. (UF767 Un3.1nm Contin.)

See also: **11223** (gas plating of tools); **11653** (structural changes during rolling).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

11637* A Contribution to the Study of the Extraction and Analysis of Non-Metallic Inclusions in Carbon Steels. Electrolytic extraction of oxides can be conducted with a steel specimen above 120 g. The residual weight obtained permits further analysis without the microscopic process. The eventual presence of hydrolytic Fe and the treatment with HCl removes the FeO free from the inclusions of the oxides. Separating carbides by physical means produces a pure fraction of oxides which permits the microscopical determination of the physical properties. (*In Portuguese.*) Contribuição ao estudo de extração e análise de inclusões não metálicas em aços ao carbono. ***Eduardo Penna.*** *ABM (Boletim da Associaçao Brasileira de Metais)*, v. 16, no. 59, Apr. 1960, p. 387-399.

11638* On the Mosaic Structure of Ferrite in Magnesium Cast Iron. Microscopic investigations showed the dependence of the substructure on preliminary heat treatment. The influence of the mosaic structure of ferrite on the nucleation and growth of austenite is noted. (*In Ukrainian.*) Pro mozayichnu budovu ferytu v magniyiovomu chavuni. ***K. P. Bunin and O. I. Iatsenko.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1960, no. 4, p. 451-455.

11639* On the Phases of the Chromium—Nickel—Niobium System. The system was investigated on high-purity alloys within a range of up to 50 p.c. Nb by weight. Quasi-binary sections were constructed in the examined part of the ternary system, as well as isothermal sections at 1100 C and 1175 C. A new ternary intermetallic compound was discovered, with a composition approximately corresponding to the formula $Ni_8Cr_8Nb_2$. (*In Ukrainian.*) Pro fazy systemy khrom-nikel'-niobiyi. ***V. M. Svyechnykov and V. M. Pan.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1960, no. 5, p. 634-637.

11640* Structural State of the "White" Layer Formed Under the Effect of a Pulse Stream of High-Temperature Gases. The "white" layer has the structure of highly dispersed nonhomogeneous microglobular martensite with an elevated C content in most of its volumes. In the outer part of the "white" layer, austenite appears due to the diffusion of C and N from the gas medium. The concentration of these elements in austenite is far greater than in martensite. (*In Ukrainian.*) Strukturniyi stan "bilogo" sharu utvorenogo pid vplyvom impul'snogo potoku gaziv vysokoyi temperatury. ***B. D. Grozin, S. B. Nizhnik, and V. F. Iankevich.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1960, no. 5, p. 638-641.

11641* On Austenite Formation in Rapid Heating. The magnetometric method was employed to study the dependence of the martensite point positions of Y8A and IIIX 15 steels on the heating temperature and duration. The rate of heating was about 2000° per second. It was shown that the values of the martensite points depend greatly on the quenching temperature and the elapsed time before quenching. (*In Ukrainian.*) Do pytannia pro utvorennia austenitu pry shvydkykh nagrivanniakh. ***V. N. Gridnyev and Y. Y. Myeshkov.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1960, no. 6, p. 780-783.

11642 Effect of Manganese on the Austenite-Pearlite Transformation. Measurements of rate of growth, thermodynamic quantities, and partitioning of Mn are reported for high-purity eutectoid Fe-C and Fe-C-Mn steels for the austenite-pearlite reaction. Evaluation of the constants of a derived-rate equation with these data indicate that Mn additions cause the decrease observed by increasing the activation energy and apparent activation entropy for the movement of complexes at the interface. ***M. L. Picklesimer, et al.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 473-480.

11643 Phase Transformations in Nickel-Rich Nickel-Titanium-Aluminum Alloys. Phase transformations in a series of relatively pure Ni-Ti-Al binary and ternary alloys were studied. The purpose was to clarify age-hardening mechanisms, especially in predominantly Ti-hardened compositions. The stability of the γ phase under nonequilibrium conditions was shown to be important in this system. ***J. R. Mihalisin and R. F. Decker.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 507-515.

11644 Single-Crystal Growth and Purification of Tantalum. A reliable technique has been developed for producing single crystals of Ta in the form of small diameter wires. By suitably heat treating these and polycrystal samples, first in an O atmosphere and finally in vacuum, it has been found possible to reduce residual resistivities to 10^{-8} microhm-cm. ***D. P. Seraphim, J. I. Budnick, and W. B. Ittner, III.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 3, June 1960, p. 527-533.

11645 Annotated Equilibrium Diagrams of Some Aluminium Alloy Systems. *H. W. L. Phillips.* 86 pp. 1959. The Institute of Metals, London. (TN775 In7a)

11646* Metallographic Polishing of Very Hard Materials. The problem, when assessed in the light of modern knowledge on the use of diamond abrasives in general metallographic practice, resolves itself into the development of suitable abrasion laps. The manufacture of satisfactory diamond-impregnated plastic laps is described, and it is shown how these laps can be incorporated in a rapid and reliable polshing procedure. Repre-

sentative results obtained with tungsten carbide and silicon carbide compacts are given. ***L. E. Samuels.*** *Australian Institute of Metals, Journal,* v. 5, no. 1, May 1960, p. 63-67.

11647* Diffusion of Some Elements From One Source Into Iron and Its Alloys. Investigating the diffusion of some elements at the same time, from one source by local spectral analysis with a linear source, was found possible. Diffusion of Mn, Cr, Si, and Mo from one source into Fe and into binary Fe-based alloys, each one containing 3 at.% Co, Cr, Si, and V, was tested. Velocity of diffusion increases in the following sequence: Ti, Mn, Cr, Si, and Mo. The alloyed elements slow down diffusion. (*In Russian.*) Diffuziia neskol'kikh elementov iz odnogo istochnika v zhelezo i ego splavy. ***M. A. Krishtal.*** *Fizika Metallov i Metallovedenie,* v. 9, no. 5, May 1960, p. 680-688.

11648* The Growth of a Lead Selenide Layer. The growth and structure of a diffusion PbSe coating formed by contact of hard Pb with molten Se is described. (*In Russian.*) O roste sloia selenida svintsa. ***V. A. Dorin and G. M. Filaretova.*** *Fizika Metallov i Metallovedenie,* v. 9, no. 5, May 1960, p. 718-721.

11649* Considerations on the Gas Contents in Dissolved or Combined Form in Iron-Carbon Casting Alloys. The presence of up to about 5.5 cm^3/100 g of H can be determined in the liquid phase by the analysis of the specimens cast in a Cu mold. The presence of C and Si cause a decrease of the solubility of the ferrous oxide in the liquid state. (*In German.*) Betrachtungen über Gasgehalte in gelöster und gebundener Form in Eisen-Kohlenstoff-Gusslegierungen. ***Anton Köniğer and Manfred Odendahl.*** *Giesserei, Technisch-Wissenschaftliche Beihefte,* no. 28, Apr. 1960, p. 1545-1555.

11650* Formation of Spheroidal Graphite in Cobalt-Aluminum-Carbon and Cobalt-Tin-Carbon Alloys. In Co-Al-C, as well as in Co-Sn-C alloys, spheroidal graphite is formed. In the case of high Al or Sn contents, these spherules are surrounded by a zone consisting of ternary carbides Co_3AlC_x or $CoSnC_x$. The type of the structure formation suggests the production of the graphite spherules from the melt. (*In German.*) Bildung von Kugelgraphit in Kobalt-Aluminium-Kohlenstoff-und Kobalt-Zinn-Kohlenstoff-Legierungen. ***L. J. Hütter and H. H. Stadelmaier.*** *Giesserei, Technisch-Wissenschaftliche Beihefte,* no. 28, Apr. 1960, p. 1563-1565.

11651* Solidification and Structure Formation of the Aluminum-Silicon Eutectic. According to thermal and microscope investigations, decreasing the eutectic temperature has the highest effect on the structure being formed, but, produced by elevated cooling velocity or by slight modifications of the composition, especially by addition of Na or P, it has no real effect on the size and form of the Si phase. Concerning the growth of the Al-Si eutectic, an Al-rich solid solution is formed and a part of the Si phase is produced. (*In German.*) Erstarrung und Gefügeausbildung des Aluminium-Silizium-Eutektikums. ***S. Ghosh, J. Wilcock, and V. Kondic.*** *Giesserei, Technisch-Wissenschaftliche Beihefte,* no. 28, Apr. 1960, p. 1575-1580.

11652* Study of Ferritic Grain Boundaries in Iron and Low-Carbon Steels. The effect of gradual etching of (multiple) boundaries represents an objective reality originating in the crystallographic constitution of this region. Multiple boundaries are neither inclined with $\sigma > 35°$ nor twisted ones. The classification into boundaries with a small angle and those with a big one merely has a formal significance because a qualitative difference exists between them. It is possible that the grades of multiple boundaries are some measure of the dislocation system which can be made visible, due to the Cottrell atmosphere composed of interstitial atoms. (*In Slavic.*) Študium hraníc feritických zrn v zľeze a nízkouhlíkových oceliach. ***Ivan Hrivňák.*** *Hutnické Listy,* v. 15, no. 6, June 1960, p. 432-441.

11653 Structural Changes in 99.990% Pure Aluminium During Rolling and Annealing. A detailed X-ray and metallographic study was made of the structural changes that occur in pure Al (99.990%) on cold rolling with reductions ranging from 20 to 98.7% and on subsequent annealing with both slow and rapid rates of heating. During cold rolling, the individual crystals of the initial slab are deformed in direct proportion to the reduction of the strip. With rapid heating of heavily rolled strip, the metal is raised to a temperature at which cube texture can form before the crystallites growing by the first recrystallization process have become large. ***T. Ll. Richards and S. F. Pugh.*** *Institute of Metals, Journal,* v. 88, pt. 9, May 1960, p. 399-405.

11654* Phenomena Occurring in the Quenching and Tempering of Steels. The nature of martensite, peculiarities of the structure of low carbon steel, imperfections in the structure of martensite crystals, nature of the high hardness of quenched steel, nature of the austenite-martensite transformation, factors causing the transformation, temperature dependence of the transformation rate, tempering of quenched steel, formation of carbide phase on tempering are discussed. ***G. V. Kurdjumov.*** *Iron and Steel Institute, Journal,* v. 195, pt. 1, May 1960, p. 26-48.

11655 Precipitation of Nitrides in the Structure of Transformer Steel. An investigation of structural changes taking place in brittle transformer sheet has been undertaken by means of hardness measurements, thermal analysis, optical and electron microscopy, and X-ray and electronographic structural analysis; shows that N is the active element which particpates in the formation of the brittle phases. In the range of temperatures up to 250 C, N is precipitated from the alpha solid solution in the form of nitrides of iron $Fe_{16}N_2$ and Fe_4N, which are deposited in the matrix. ***J. Ježek, J. Vobořil, and V. Cihal.*** *Iron and Steel Institute, Journal,* v. 195, pt. 1, May 1960, p. 49-55.

11656* Effects of Cobalt on Transformations During Tempering and on Red Hardness of Cast High-Tungsten High-Speed Steel. During molding Co increases the quantity of residual austenite in the quenching process of this type of steel. Up to 10% does not influence the resistance of the residual austenite to tempering, but more than 10% does. Co considerably increases the red hardness of the steel tested. Optimum tempering conditions were studied in order to obtained maximum hardness. (*In Russian.*) Vliianie kobal'ta na prevrashcheniia pri otpuske i krasnostoĭkost' litoĭ vysokovol'framovoĭ bystrorezhushcheĭ stali. ***V. A. Kashchuk.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia,* 1959, no. 12, p. 139-142.

11657* Determination of the Critical Points in the Commercial Titanium Alloys VT-3 and VT-3-1. The single-phase β-region for the alloy VT-3 is obtained by heating up to 1100 C, and for the alloy VT-3-1, by heating up to 1000 C. The lowest critical point (probably eutectoid) is equal to 530 C $\pm$ 10 for VT-3, and to 500 C $\pm$ 10 for VT-3-1. The change of 0.75% Cr for 1.7% Mo lowers the upper and lower critical points nearly to 100 C. The anneal structure of VT-3 is obtained at a cooling speed of 15 C per hour, and of VT-3-1, of 40 C per hour. (*In Russian.*) Opredelenie kriticheskikh tochek v promyshlennykh titanovykh splavakh VT-3 i VT-3-1. ***Z. S. Verigina and B. G. Livshits.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia,* 1960, no. 5, p. 163-171.

11658* Effects of Small Cobalt Concentrations on the Self-Diffusion of Iron. Additions of up to 1 wt.% of Co sharply decreases the energy of activation of self-diffusion in γ-iron. During the subsequent increase in Co concentrations, the energy of activation generally tends to increase. (*In Russian.*) Vliianie malykh kontsentratsiĭ kobal'ta na samodiffuziiu zheleza. ***V. V. Sanadze and T. A. Tsivtsivadze.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Fizika,* 1960, no. 2, p. 206-209.

11659 *p* Layers on Vacuum Heated Silicon. It was established that when Si is heated above 1300 K in a borosilicate glass vacuum system from 10^{11} to 10^{15} acceptors per cm^2 are normally added to the Si surface, even though the glass walls remain at room temperature. The acceptor diffuses into the surface upon heating, forming a *p* layer several microns deep. There is strong evidence that the acceptor is B from the borosilcate glass envelope. The transfer to the Si is believed to occur through volatilization of boron oxides by water vapor. ***F. G. Allen, T. M. Buck, and J. T. Law.*** *Journal of Physics,* v. 31, June 1960, p. 979-985.

11660 Single-Crystal Magnetic Anisotropy and Magnetostriction Studies in Iron-Base Alloys. Single crystals of a number of binary iron-base alloys were grown, fabricated, and tested for magnetic anisotropy (K_1) and magnetostriction (λ_{100} and λ_{111}). The additions made to Fe included V, Mo, Ge, Cr, Ti, and Sn. The anisotropy of Fe was lowered by the addition

elements with the possible exception of Sn. On the other hand, λ_{100} of Fe was generally raised by these addition elements. Only Ti and Sn lowered λ_{100}; however, Ti had limited solubility in Fe and Sn caused embrittlement. ***R. C. Hall.*** *Journal of Applied Physics,* v. 31, June 1960, p. 1037-1038.

11661 Displacement of the Sulfur Atom in CdS by Electron Bombardment. The threshold for displacement of the S atom from a lattice point in CdS has been measured to be 8.7 ev. This is also the threshold for the production of green edge emission centers and of centers for a red fluorescence band with a maximum intensity at about 7200 A. The red luminescence is not removed by electron bombardment but increases in intensity with bombardment above the threshold. The radiation "annealing" of the edge emission is accomplished even in crystals which do not thermally anneal. A model is proposed with the S interstitial atom the center for edge emission, and the S vacancy the center for the red emission band. ***B. A. Kulp and R. H. Kelley.*** *Journal of Applied Physics,* v. 31, June 1960, p. 1057-1061.

11662 Etch Pits at Dislocations in Copper. A high-temperature anneal is found to lower the dislocation density of melt-grown crystals. A "double-etch" technique is employed to observe the motion of dislocations, and to show that the dislocations initially present in these crystals are mobile at low stresses. Sub-boundaries are numerous in these crystals and are found capable of hindering dislocation movement. ***J. D. Livingston.*** *Journal of Applied Physics,* v. 31, June 1960, p. 1071-1076.

11663 Theory of Dislocation Climb in Metals. An estimate of the climb motion of dislocation jogs is given, which takes into account the fact that dislocations are pipes of easy diffusion. The climb of dislocations under near-equilibrium conditions is then discussed. A new estimate is made of the jog concentration, for which vacancy equilibrium will be established along the entire dislocation. It is argued that the dislocation line tension is an important driving force both in high-temperature creep and in whisker dekinking. ***Jens Lothe.*** *Journal of Applied Physics,* v. 31, June 1960, p. 1077-1087.

11664* Study of a Solid Gallium Phase Unstable at Atmospheric Pressure. With Ga at high pressures, there is a solid Ga II-phase denser than the liquid; by extrapolation of the liquid Ga II equilibrium curve, the melting point of this phase can be determined. Heterogeneous nucleation is studied in order to explain the superfusion of the liquid metallic masses in several grams and the persistence of nuclei of the stable phase in the liquid. (*In French.*) Etude d'une phase solide de gallium instable à la pression atmosphérique. ***André Defrain.*** *Métaux Corrosion-Industries,* v. 35, May 1960, p. 175-189.

11665* Contribution to the Spectrochemical Microanalysis of Isolated-Oxidic Inclusion Containing Steels. Methods of stimulating dissolutions, test preparation for dissolution spectral analysis, conditions of stimulation and absorption, evaluation of spectrum, choice of lines used in the evaluation of the spectrum, plotting of standard curves are discussed. (*In German.*) Beitrag zur spektrochemischen Mikroanalyse aus Stählen isolierter oxydischer Einschlüsse. ***Karl-Friedrich Lüdemann, Hans-Werner Fenzke, and Fritz Gruner.*** *Neue Hütte,* v. 5, Apr. 1960, p. 238-244.

11666 Point Defects in Platinum. An investigation was made of the mobility and types of point defect introduced in Pt by deformation in liquid N, quenching into water from 1600 C, or reactor irradiation at 50 C. These experiments indicated that the principal defects remaining in Pt after irradiation were single vacant lattice sites and after quenching were pairs of vacant lattice sites. ***G. R. Piercy.*** *Philosophical Magazine,* v. 5, ser. 8, Mar. 1960, p. 201-221.

11667 Electronic Structure of Tin Investigated by Ultrasonic Attenuation. The magnetic field dependence of the ultrasonic attenuation was measured in very pure Sn single crystals. Oscillations were found that can be explained as a result of resonant conditions between the electron orbit diameter and the periodic field set up by the sound wave. These oscillations yield information about the Fermi-momentum. ***Tore Olsen.*** *Physical Review,* v. 118, 2nd ser., no. 4, May 15, 1960, p. 1007-1008.

11668 Band Structure of Aluminum. Calculations of the band energies at symmetry points in Al by Heine are extended into the zone using the pseudopotential interpolation scheme in order to obtain constant-energy curves in the neighborhood of the Fermi surface. In conjunction with this calculation, the lines of contact between various bands are found in detail. ***Walter A. Harrison.*** *Physical Review,* v. 118, 2nd ser., no. 5, June 1, 1960, p. 1182-1189.

11669 Electronic Structure of Polyvalent Metals. A single-orthogonalized-plane-wave approximation is defined and used to construct the Fermi surfaces for face-centered-cubic and body-centered-cubic metals of valence one through four and for hexagonal-close-packed metals of valence one through three. The de Haas-van Alphen effect, cyclotron-resonance effect, and anomalous-skin effect are discussed in terms of these surfaces and the deduced properties are compared with experiment where suitable experiments exist. ***Walter A. Harrison.*** *Physical Review,* v. 118, 2nd ser., no. 5, June 1, 1960, p. 1190-1208.

11670* Studies of Isothermal Transformations of Supercooled Austenite. An apparatus was designed for isothermal investigations based on measurement and recording of magnetic saturation. It comprises an electromagnet, a magnetometer with resistance strain gages, a system for austenitizing and isothermal holding of samples, and a recorder. Performance is satisfactory. As an example, isothermal transformation curves of supercooled austenite in Cr-Ni, Si-W, and Cr-Ni-V-Mo steels were given. (*In Polish.*) Badania izotermicznych przemian przechłodzonego austenitu. ***W. Ciaś.*** *Prace Instytutów Hutniczych,* 1960, no. 2, p. 61-78.

11671* Isothermal Decomposition of Austenite in Steel ARC 3. In this steel, in the intermediate interval, there is an upper region with formation of surface bainite and perlite; the kinetic curves for temperatures between 450 and 350 C have two branches corresponding to the reactions of formation of these constituents; perlite eliminates undercooled austenite almost entirely. There is a lower region where lower bainite is formed due to austenite decomposition. (*In Russian.*) Izotermicheskiĭ raspad austenita v stali ARC 3. ***B. Rotenshtein and N. Dregan.*** *Revue Roumaine de Métallurgie,* v. 5, no. 1, 1960, p. 25-39 + 8 plates.

11672 A Study of Ternary Phase Diagrams of Tungsten and Tantalum. Investigated phase relationships in 36 ternary refractory metal systems. Nearly 200 ternary alloy compositions prepared from high-purity alloying ingredients by nonconsumable electrode arc-melting procedures. Scanned the solid solubility limits to ternary systems based on W and/or Ta and involving Mo, Nb, V, Cr, Os, and Re. ***W. Rostoker.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 59-492, Mar. 1960, 85 pp. (TL507 Un3.18w Vis.)

See also: **11603** (inclusions in ultra-high-strength steels); **11623** (structure of Al-killed deep-drawn steel sheet).

METALS—POWDER

11673 How Hydrides Solve Problem of Forming Metal Parts. No longer lab curiosities, metal hydrides—particularly of Zr and Ti—are finding wide application in industry all consistent with their ability to evolve H. ***J. D. Roach.*** *Iron Age,* v. 186, no. 2, July 14, 1960, p. 108-109.

11674 Powder-Metal Parts. Discusses basic and special-use powder materials and their properties, advantages and limitations of the powder-metallurgy process, and principles of part design. *Machine Design,* v. 32, July 7, 1960, p. 112-122.

11675* The Use of Electric Resistivity in Measuring the Degree of Sintering. Electrolytic Fe powder, spectroscopically pure and less than 60μ in grain size, revealed two sintering zones, one up to 500 C characterized by a marked decrease of resistivity when the temperature increased, the other between 500 and 1000 to 1100 C with little variation of the resistivity but with slow and continuous modifications. The sharp decrease of resistivity during early sintering is due to the oxide films and to

metallic contact. (*In French.*) Utilisation de la résistivité électrique pour mesurer le degré de frittage. ***Georgeta Dan and Aurelia Protopopescu.*** *Revue Roumaine de Métallurgie*, v. 5, no. 1, 1960, p. 107-117.

11676 Fluidized-Bed Coating of UO_2 Powder With Niobium and Other Elements. The chemical vapor deposition of Nb, Mo, W, Cr, C, and Nb-V alloys in a fluidized bed of UO_2 powder particles has been used to provide uniform, dense, nonporous coatings on the individual particles. In the case of Nb, which received major attention, H reduction of $NbCl_5$ vapor was used as the vapor-deposition reaction. The most serious problem was that of maintaining bed fluidity and avoiding agglomeration. This problem was overcome to permit routine operation of the coating equipment. ***John M. Blocher, Jr., Neil D. Veigel, Joseph H. Oxley, Virginia M. Secrest, and Erland E. Rose.*** *U. S. Atomic Energy Commission, BMI-1440*, May 25, 1960, 45 pp. + appendix. (UF767 U3b Contin.)

11677 An Evaluation of Data on Nuclear Carbides. Available data on the physical and mechanical properties, constitution, compatibility, and radiation behavior and on fabrication methods for U, Th, and Pu carbides were reviewed. Very incomplete data on Th and Pu carbides were located. Only limited data on the physical and mechanical properties of U carbides were discovered. No information on high-temperature mechanical properties was found. Considerable information concerning the constitution of the carbides was obtained, however, and ternary diagrams were constructed. The incomplete data on the compatibility and corrosion behavior of the carbides that were found in the literature were supplemented by thermodynamic calculations for various possible reactions with coolants and claddings. Available information on preparation of bulk carbides was reviewed and data on thermodynamics, preparation by chemical reactions, melting and casting, solid-phase fabrication, and storage and handling were assembled. ***Frank A. Rough and Walston Chubb.*** *U. S. Atomic Energy Commission, BMI-1441*, May 31, 1960, 100 pp. (UF767 U3b Contin.)

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

11678 Industry Practice for Fluid Penetrant Inspection of Steel Tubular Products. Covers procedures for the nondestructive fluid penetrant testing of austenitic and ferritic steel tubular products by the manufacturer. The principle, penetrant test materials, procedures, examination, rejection limits are discussed. *American Iron and Steel Institute, Contributions to the Metallurgy of Steel*, Apr. 1959, 5 pp. (TN705 Am35c Vis.)

11679 Industry Practices for Ultrasonic Nondestructive Testing of Steel Tubular Products. Covers procedures for ultrasonic nondestructive testing of austenitic and ferritic round steel pipe or tubing by the producer. It is applicable to such material in a wide range of sizes. *American Iron and Steel Institute, Contributions to the Metallurgy of Steel*, Apr. 1959, 4 pp. (TN705 Am35c Vis.)

11680 Industry Practices for Eddy Current Testing of Carbon, Stainless and Alloy Steel Tubular Products. Covers procedures for nondestructive eddy current testing of austenitic and ferritic steel tubular products by the manufacturer. The principle, material requirements, instrumentation, calibration standard, instrument calibration, testing procedure, and rejection limits are discussed. *American Iron and Steel Institute, Contributions of the Metallurgy of Steel*, July 1959, 4 pp. (TN705 Am35c Vis.)

11681* Sampling Inspection as a Minimum Loss Problem. The producer's problem, the minimum regret solution in different cases, the buyer's problem, and application of game theory are discussed and calculated. ***B. L. van der Waerden.*** *Annals of Mathematical Statistics*, v. 31, no. 2, June 1960, p. 369-384.

11682 Annual Convention Transactions 1960. Fourteenth Annual Convention American Society for Quality Control. Quality control and its application are discussed. 364 pp. 1960. American Society for Quality Control, Inc., Milwaukee, Wis. (TS155 Am35c Vis.)

11683 French Metallurgical Research Based on Radioelements. Reasons for selecting a radioelement for a definite application are given; the importance of the autoradiographic technique in examining heterogeneities in metallic alloys is emphasized. The factors influencing the amount of segregations in steels, the presence of heterogeneities at the grain boundaries of metals, the measure of the coefficients of diffusion, the determination of impurities in pure metals, and the use of radioelements in steel metallurgy are studied. (*In French.*) Les recherches françaises en métallurgie réalisées au moyen des radioéléments. ***A. Kohn.*** *Institut de Recherches de la Siderurgie, Publication*, ser. B, no. 44, Feb. 1960, 24 pp. (TN602 In7p Vis.)

11684* New Plastic Blending and Distribution System Cuts Costs and Aids Quality Control in Wire Insulation Processing. Nearing completion today is a $40,000 project which will result in what is called an "integrated powder blend distribution system". Essentially it is a Convair conveyor system of a self-cleansing type. The new system will deliver one of three required PVC formulations, in black or natural, to each of six extruders at six locations. ***David Barr and M. M. Orend.*** *Insulation*, v. 6, July 1960, p. 47-51.

11685* New Types of Nondestructive Electrolytic Polishing Methods and Replica Techniques on Metal Surfaces. The Ellopol method of local electrolytic polishing and a varnish replica method were described as new processes of optical and electron optical nondestructive metallography. (*In German.*) Neuartige zerstörungsfreie elektrolytische Polierverfahren und Abdrucktechniken auf Metalloberflächen. ***P. A. Jacquet.*** *Metalloberfläche*, v. 14, June 1960, p. 161-170.

11686 Research and Development Leading to the Establishment of Ultrasonic Test Standards for Aircraft Materials. It was found that: (1) Most significant of the material variables affecting compressional wave energy is the amount of working to which the material is subjected; (2) The more important factors in determining the quantities of shear and surface wave energy are the sheet thickness and the flaw size to sheet thickness ratio; (3) A very useful system for selecting collimator orifice diameters is that described by the function $D = \sqrt{2 R \lambda}$, where D is the diameter, R is the flaw depth, and λ the wavelength; and (4) Ultrasonic and mechanical properties show good correlation as far as fatigue life and ductility are concerned. ***G. L. Cross, R. E. Kleint, and R. D. McKown.*** *U. S. Air Force Wright Development Division, WADD Technical Report* 59-466, Feb. 1960, 138 pp. (TL507 Un3.18w Vis.)

11687* Eddy Current Testing of Superalloy Weldments. Breakthrough in weld inspection is expected to help develop new techniques for fabricating the difficult-to-weld superalloys. *Welding Design & Fabrication*, v. 33, July 1960, p. 41-42.

11688* Quality Control Can Be Easy and Accurate With Careful Preparation. Large structural weldments can be produced with a minimum of defects, if proper preparations are first made. Outlines one such quality control plan, which can be used as a guide by any and all manufacturers. ***H. K. Eitelman.*** *Welding Engineer*, v. 45, July 1960, p. 28-31.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

11689* The Carbonic Dioxide Nuclei. A study covering the methods of CO_2 determination, natural variations of the CO_2 concentration, effects of light and of the effective substance, tentative separation of the nuclei, application of the membrane filter method, size, number and structure of the nuclei. (*In German.*) Die Kohlensäurekerne. ***Georg Stetter.*** *Acta Physica Austriaca*, v. 13, nos. 2-3, May 1960, p. 185-206.

11690* Investigations of the Theory of the Particle Motion in the Contemporary Cyclic Accelerators. Study of: linear and nonlinear theory of the betatron vibrations in magnetic periodic systems, first in strong focusing systems, critical energy in strong focusing in proton-synchrotons, motion of electrons in cyclic accelerators at high energies, account being taken of the effects of irradiation, theory of the ring phasotron, a new ring accelerator in a time constant field. (*In Russian.*) Is-

sledovaniia po teorii dvizheniia chastits v sovremennykh tsiklicheskikh uskoriteliakh. ***A. A. Kolomenskii.*** *Akademiia Nauk SSSR, Fizicheskii Institut, Trudy,* v. 13, 1960, p. 3-129.

11691* Application of Dispersion Relations to Nucleon-Nucleon Scattering: The Two-Pion Contribution. The two-pion contribution to the amplitude for nucleon-nucleon scattering is computed in terms of the invariant amplitudes which characterize the four-body Green's function of the pion nucleon system. The dependence of this contribution upon the momentum transfer of the two-nucleon system is completely exhibited. ***Marvin L. Goldberger and Reinhard Oehme.*** *Annals of Physics,* v. 10, June 1960, p. 153-170.

11692* Flow Inversions in Gas Cooled Reactors. In a gas-cooled reactor with downward coolant flow, recirculation may occur in some cooling channels. Shows that there is a rather broad region of partial load, in which inverse flow is self-sustaining. However, in the larger part of that region, a normal downward flow cannot change to the adverse direction. (*In German.*) Strömungsinversionen bei gasgekühlten Reaktoren. ***H. Benzler.*** *Atomkernenergie,* v. 5, May 1960, p. 165-172.

11693* Derivation of the Mean Number of Secondary Neutrons Per Fission From the Mass Distribution of the Products. The error of the method was evaluated. When the curves of mass distribution of the products were closely studied, the mean number of secondary neutrons per fission $\bar{\gamma}$ can be determined with sufficient accuracy. The values of $\bar{\gamma}$ were calculated for different cases of fission of Th^{232}, U^{233}, U^{235}, U^{238}, Pu^{239}, Am^{241} and Cf^{252}. Results are discussed and compared with those of other methods. (*In Russian.*) Srednee chislo vtorichnykh neĭtronov deleniia i nakhozhdenie ego iz raspredeleniia oskolkov po massam. ***Iu. A. Zysin, A. A. Lbov, L. I. Sel'chenkov.*** *Atomnaia Energiia,* v. 8, no. 5, May 1960, p. 409-412.

11694* The Structures and Properties of Some Metals and Steels After Irradiation With Fast Neutrons. A study of the effects of irradiation with fast neutrons, and of the subsequent thermal treatment, on the properties of some metallic materials. The change of the properties of the materials during irradiation is explained by the formation of a different type of defects in the crystal lattice, which are annealed at corresponding temperatures. Kinetics were studied and the energy of activation of the processes involved in eliminating the defects producing a hardening of the materials was determined. (*In Russian.*) Issledovanie svoĭstv i struktury metallov i nekotorykh staleĭ posle obliucheniia ikh bystrymi neĭtronami. ***Sh. Sh. Ibragimov, V. S. Liashenko, and A. I. Zav'ialov.*** *Atomnaia Energiia,* v. 8, no. 5, May 1960, p. 413-419.

11695* Filtration of the Gaseous Effluent of an Air-Cooled Reactor. ***I. A. Mossop.*** *British Chemical Engineering,* v. 5, June 1960, p. 420 + 5 pages.

11696* Neutron Activation Analysis and Nuclear Technology. Impurities which are strong absorbers of neutrons cannot be tolerated in nuclear reactor fuel elements, canning materials, moderators or coolants. One of the methods providing extreme sensitivity for the determination of many elements is neutron activation analysis, which has extensively been developed in the past two decades with the establishment of nuclear reactors. ***D. F. C. Morris.*** *Chemical & Process Engineering,* v. 41, June 1960, p. 229 + 3 pages.

11697* A Contribution to the Study of the Quantitative Determination of the High Fluxes of Ionizing Radiations. Different methods were applied in determining high fluxes of γ-radiations ($1{,}2.10^{6}$ rad/h) and of accelerated electrons (10^{6} rad/h). The most accurate methods are based on the ceric-cerous system and on the gas liberation by cyclohexane. (*In French.*) Contribution à l'étude de la dosimétries des flux élevés de rayonnements ionisants. ***Jacques Prévé and Gabriel De Gaudemaris.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 250, no. 21, May 23, 1960, p. 3470-3472.

11698* Energy Spectrum of Electron Pairs in a High Energy Photon-Electron Cascade. The energy spectrum of electron pairs generated in a high energy photon-electron cascade up to a depth of 1.5 c.u. was measured and the possible influence of the medium on the shape of the spectrum according to Landau-Pomerančuk-Ter Mikaelyan and Migdal was investigated. Two procedures were used for the analysis; no significant deviation from the Bethe-Heitler spectrum could be observed. ***J. Pernegr, V. Petržílka, J. Sedlák, and J. Vrána.*** *Czechoslovak Journal of Physics,* v. 10, no. 5, 1960, p. 342-348.

11699 Electron Accelerator Fights Cancer. Input power during treatment is dictated by the desired depth of penetration. Machine is operated only for 60 60-microsecond bursts a second. *Electronics,* v. 33, no. 28, July 8, 1960, p. 33.

11700 Gas-Cooled Reactors. Proceedings of the Symposium sponsored jointly by The Franklin Institute and The American Nuclear Society, Delaware Valley Section, February 10 and 11, 1960. The HTGR, an advanced, high-temperature, gas cooled, graphite-moderated reactor, the army gas-cooled reactor systems program, maritime gas-cooled reactors, the experimental gas-cooled reactor design, the Australian high-temperature gas-cooled reactor research program, the Pebble bed reactor, fuel elements and materials, components and loop studies are discussed. 349 pp. 1960. The Franklin Institute of the State of Pennsylvania, Lancaster, Penn. (TK9203.G2 F85g)

11701 How Radiation Affects Engineering Materials. Gamma rays and neutrons cause property changes in the environment. Structural metals generally have best radiation resistance. Inorganic materials show many changes in physical and mechanical properties. Elastomers vary widely in radiation resistance. Plastics generally have equal or better radiation resistance than elastomers. Organic fluids can have composition adjusted to provide compromise of properties. ***Richard E. Bowman.*** *Materials in Design Engineering,* v. 52, July 1960, p. 119-134.

11702* Pressure Suppression Containment for Nuclear Power Plants. Pressure-suppression containment provides for venting into a water pool the steam-water mixture that would be released from a water-moderated reactor in the very unlikely event of a break in the primary system. The steam would be condensed and most of the entrained fission products would be retained in the pool. Describes a development program which was performed to determine feasibility of the concept and how a practical system could be designed. ***C. C. Whelchel and C. H. Robbins.*** *Nuclear Energy,* v. 14, June 1960, p. 263 + 4 pages.

11703 Fluorine Products and N-Energy. I. Hydrogen Fluoride Production and Its Uses. Fluorine is one of the most corrosive and reactive elements in the periodic table. It and some of its compounds, notably hydrogen fluoride, however, are very important in various branches of nuclear energy. Attempt is made to discuss some of the difficulties involved in handling fluorine compounds and also some of their more important applications. *Nuclear Energy,* v. 14, June 1960, p. 272-274.

11704* Partial Gamma Ray Widths for Low Lying Levels in Aluminium and Magnesium. The gamma rays resulting from the bombardment of Al and Mg with protons of 3.3 to 4.2 MeV energy were used to excite low lying levels in Al^{27}, Mg^{24}, and Mg^{25}. Combining the results of self absorption and resonance scattering studies with measured branching ratios, the following partial widths Γ_0 for the ground state transitions were obtained. ***F. R. Metzger, C. P. Swann, and V. K. Rasmussen.*** *Nuclear Physics,* v. 16, no. 4, June 1960, p. 568-590.

11705* On the Coupling of a $j = \frac{s}{s}$ Particle to Nuclear Quadrupole Surface Oscillations. An intermediate coupling calculation is performed for a nucleon confined to move in a $j = \frac{s}{2}$ orbit and coupled to a nuclear surface capable of performing quadrupole oscillations. It is shown that each term in the hamiltonian commutes with a symplectic group of transformations. This feature is used to define a representation in which the hamiltonian matrix takes an especially simple form. ***B. F. Bayman and L. Silverberg.*** *Nuclear Physics,* v. 16, no. 4, June 1960, p. 625-644.

11706* Spectra of γ-Rays From Neutron Capture by Heavy Nuclei (II). The spectra of γ-rays accompanying thermal neutron capture are calculated for dipole γ-radiation for

two variants of the dependence of nuclear level density on energy. Parameters for the formula of nuclear level density are determined from comparison with experimental spectra. The results thus obtained for nuclear level density are compared with the data derived from other experiments. ***V. M. Strutinski, L. V. Grosher, and M. K. Akimova.*** *Nuclear Physics*, v. 16, no. 4, June 1960, p. 657-673.

11707 Surface Perturbation Theory. A surface perturbation method to determine reactivities is described which has application to the removal of reflectors, the lowering of water levels in reactors, the introduction of voided beam tubes, the insertion of black control rods, etc. ***Jeffery Lewins.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 481-486.

11708 Flat Flux by Nonuniform Moderation. The production of flat thermal flux by the nonuniform distribution of the moderator is discussed within the framework of two group theory for two region reactors. Equations determining the moderator distribution are derived and a numerical solution is presented for a typical reactor system. ***Jack M. Ravets and John R. Lamarsh.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 496-501.

11709 Parameters of the Lu^{176} Neutron Resonance at 0.142 ev. The total cross section of Lu^{176} was measured over the range of neutron energies from 0.02 to 0.25 ev. The data were taken with a sample enriched to 70.2% in Lu^{176}. The resonance at 0.142 ev in Lu^{176} was fitted to a Breit-Wigner single-level formula by the method of shape analysis. ***Joseph P. Roberge and Vance L. Sailor.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 502-504.

11710 The Black Void Reactor Concept. The application of heavily loaded cylindrical fuel elements to two principal reactor configurations is considered. The objective of the work is the design of research reactors suitable for radiation effects studies. ***C. O. Muehlhause.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 505-507.

11711 In-Pile Loop Study of UO_2-NaK Slurry. The effect of fission on circulating a UO_2-NaK suspension has been studied up to a total U burnup of 0.07%. A loop of one-half inch stainless steel tubing with a test volume of 250 cc was irradiated in the Argonne CP-5 reactor. Analytical results after termination of the experiment revealed the distribution of some fission products. 45.5 per cent of the Kr and Xe fission gases were found in the cover gas. Eighty-two per cent of the Cs was found dissolved in the NaK. Cerium and Zr were found with the UO_2. ***R. D. Carlson.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 508-513.

11712 Measurements of Parameters Leading to p_{28}, f, and ϵ in Light Water Moderated 4.48% and 2.73% Enriched Lattices. At part of the Yankee and the Belgian Reactor-3 Critical Experiments program at the Westinghouse Reactor Evaluation Center, measurements have been made of the parameters leading to p, f, and ϵ in a light-water moderated heterogeneous reactor with slightly enriched UO_2 fuel rods clad in stainless steel. A detailed description of this reactor is given. ***Victor E. Grob, E. Santandrea, and Hilmar Ritz.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 514-524.

11713 The Prediction of Stream Volume Fractions in Boiling Systems. The results of an extensive study of the relative velocity of two-phase mixtures at ANL are presented. The parameter ranges studied are pressure 150-2000 psi, mixture quality 0-0.25, superficial liquid velocity 0.5-8 ft/sec, and flow-channel equivalent diameters of 0.4-2 in. The data show that the velocity ratio is affected primarily by pressure, mixture quality, superficial velocity, and to a lesser degree by the flow-channel geometry. Working curves for the prediction of the velocity are then presented which are adequate for system analyses. ***J. F. Marchaterre and M. Petrick.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 525-532.

11714 Boundedness and Stability in Nonlinear Reactor Dynamics. A novel formulation of the problem of boundedness and stability of the power level of a nuclear reactor describable by a nonlinear model is presented. A sufficient criterion for boundedness and stability is derived and proved to be equivalent to the criterion suggested by Welton. ***Elias P. Gyftopoulos and Jacques Devooght.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 533-540.

11715 An H_2O-D_2O Moderated Reactor. Calculations are made of the infinite multiplication factor in natural uranium dioxide lattices employing mixtures of light and heavy water as a moderator. The three parameters varied in the study are the metal-to-water volume ratio, pin diameter, and light-to-heavy water atomic ratio. Maxima in plots of K_∞ vs hydrogen-to-deuterium ratio indicate that such $H_2O + D_2O$ mixtures would prove advantageous in certain cases. ***Norman P. Klug and P. F. Zweifel.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 541-544.

11716 Breeding Ratio in U^{233} and Pu^{239} Fueled Reactors. Breeding ratios for clean near-thermal systems containing only U^{233} and moderator have been presented by Chernick and Moore. This work treats Pu^{239} systems also and extends the results in both systems to take account of the effects of the higher isotopes and fission products. The extra absorption by these higher isotopes tends to depress the breeding ratio, but fission in U^{235} or Pu^{241} compensate for this, and the net effect, as will be seen, is an increase in breeding ratio for Pu-fueled systems. ***Melvin M. Levine.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 545-551.

11717 Neutron Spectroscopy With Nuclear Explosions. A research reactor would have to operate for thousands of years to produce as many neutrons as a single nuclear explosion. Experiments designed around this enormous source intensity could improve by an order of magnitude our knowledge of resonance cross sections. ***Donald J. Hughes.*** *Nucleonics*, v. 18, July 1960, p. 54-58.

11718 Criticality of MTR-Type Fuel Elements. A simple graphical method can be used to predict the criticality of water-reflected MTR-type fuel elements. The basic assumption is that the criticality of a parallel-plate core can be predicted by the simple formula $K_{eff} = k_\infty/(1 + M^2B^2)$. ***Robert E. Lightle.*** *Nucleonics*, v. 18, July 1960, p. 59.

11719 Reducing Radioactivity Buildup in PWR's. Buildup of long-lived radionuclides on primary-system surfaces can make operation and maintenance difficult. SM-1 experience indicates some design considerations that could minimize buildup. ***William S. Brown and Carl A. Bergmann.*** *Nucleonics*, v. 18, July 1960, p. 60-63.

11720 Selecting Instruments for Organic Reactors. Instruments for calibration, flow measurement, pressure measurement, temperature measurement, and control valves are discussed. *Nucleonics*, v. 18, July 1960, p. 82.

11721 Hydrogen as a Power Reactor Coolant. Of the acceptable gas coolants, H is easily the best for heat transfer. Handling H, transportation and storage, engineering economics, material compatibility are discussed. ***Douglas Bradley.*** *Nucleonics*, v. 18, July 1960, p. 84 + 2 pages.

11722 Optimum Size and Hardness of Sites for Storage of Nuclear Weapons. A study is made of the optimum size and hardness of sites for the storage of a certain portion of the national stockpile of nuclear weapons. These weapons can be stored in existing nuclear sites, non-nuclear sites converted for the storage of nuclear weapons, and new sites built for this purpose. ***James M. Dobbie.*** *Operations Research*, v. 8, no. 3, May-June 1960, p. 338-355.

11723* Spectroscopic Determination of the Nuclear Moments of the Odd Isotopes of Gadolinium. The hfs splitting of the 5015 A, 5103 A, and 5251 A lines of Gd^{157} and Gd^{155} were obtained by the photoelectric method. The ratios $Q_{155}/Q_{157} = 0.8$ and $\mu_{155}/\mu_{157} = 0.79$ were determined. The deformation parameters and gyromagnetic ratios g_k and g_R were calculated for both isotopes. ***N. I. Kaliteevskii, and M. P. Chaika, I. Kh. Pacheva, and E. E. Fradkin.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 8, no. 1, Jan. 1960, p. 6-10.

11724 The Hardening of Lithium Fluoride by Electron Irradiation A study was made of the effect of 1 MEV electron irradiation on the mechanical properties of lithium fluoride single crystals tested in compression. The empirical relationship

$\sigma = k\phi^{1/3}$, previously used for radiation hardening in metals, is capable of representing only the medium dose results, but clearly does not fit at either low or high doses. A new mechanism of cracking in heavily irradiated lithium fluoride, similar to that proposed by Cottrell for alpha iron, was observed. ***A. D. Whapham and M. J. Makin.*** *Philosophical Magazine*, v. 5, ser. 8, Mar. 1960, p. 237-250.

11725 The Damage and Recovery of Neutron Irradiated Tungsten. ***M. W. Thompson.*** *Philosophical Magazine*, v. 5, ser. 8, Mar. 1960, p. 278-296.

11726 $(p,p'\gamma)$ Angular Correlations at Low Energy. At an incident proton bombarding energy of 6.5 Mev, angular correlations have been measured between protons scattered inelastically from various even-even nuclei and the decay gamma rays from the first excited states of these nuclei. The measured angular correlation functions are all of the form $A+B[\sin^2(\Theta-\Theta_0)]$, where Θ_0 is the axis of symmetry. None of the symmetry directions agreed with predictions of the simple direct-reaction theories. ***H. J. Hausman, G. F. Dell, and H. F. Bowsher.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1237-1246.

11727 Levels in Bi^{210} From the Bi^{209} (d,p) Reaction. Q values and differential cross sections have been measured for nuclear states in Bi^{210} excited by the Bi^{209} (d,p) reaction. A previously unobserved group with $Q = 2.35 \pm 0.03$ Mev has been found, corresponding to a state with probable proton-neutron assignment $(h_{9/2}g_{9/2})$. The observed Q value for this state is in good agreement with the Q value expected for the 1− ground state of RaE. ***C. B. Holm, J. R. Burwell, and D. W. Miller.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1247-1256.

11728 Analysis of the Two-Mode-of-Fission Hypothesis. Mass yields for gamma fission of U^{238}, proton fission of Th^{232}, alpha fission of U^{238}, and deuteron fission of normal U have been examined in terms of vector spaces for consistency with the hypothesis that for each target and projectile there are two and only two modes of fission. The first three cases are on the whole consistent with the hypothesis. The fourth is not consistent with the hypothesis. ***George P. Ford.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1261-1270.

11729 Decay of Ruthenium-105. The decay of Ru^{105} has been studied employing two scintillation spectrometers in coincidence. It is found that Ru^{105} decays to the excited levels of Rh^{105} with the emission of six β groups, with end-point energies of ∼125, 525, 915, 1080, 1150, and ∼1800 kev, the branching ratios being approximately ∼0.002, 0.068, 0.11, 0.30, 0.51, and ∼0.01, respectively. ***Babulal Saraf, P. Harihar, and R. Jambunathan.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1289-1292.

11730 He-Ion Induced Reactions of Aluminum and Magnesium. The $Al^{27}(\alpha,3p)Mg^{28}$ and $Mg^{26}(\alpha,2p)Mg^{28}$ reactions produced by the bombardment of Al and Mg targets with 42-Mev He ions have been studied. The excitation functions for these reactions are presented. ***Richard H. Lindsay and Robert J. Carr.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1293-1297.

11731 Energy Spectra and Angular Distribution of Photoneutrons From Carbon. Energy spectra and angular distribution of photoneutrons from C are studied by irradiation with a 30-Mev bremsstrahlung beam. The spectra exhibit a fine structure from which the following levels in C^{12} may be distinguished: 21.4, 22.2, 22.9, 23.6, (24.3), 24.8, and 25.6 Mev. Many of these coincide with levels found in the $C^{12}(\gamma,p)$ and $C^{12}(\gamma,3\alpha)$ reactions. Photoneutron emission occurs predominantly by transition to the ground state of C^{11}. ***V. Emma, C. Milone, and A. Rubbino.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1297-1301.

11732 Pion Production by Pions. A liquid H target was bombarded by negative pions of energies 260, 317, 371, and 427 Mev. Positive pions from the reaction $\pi^- + p \rightarrow \pi^+ + \pi^- + n$ were detected by the use of a counter telescope, that selected the π^+ by its characteristic π-μ decay. Results indicate a much larger cross section than the theoretical prediction based on the static model. Reasonable agreement can be obtained by the inclusion of a pion-pion interaction in the production mechanism. ***Walton A. Perkins, III, John C. Caris, Robert W. Kenney, and Victor Perez-Mendez.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1364-1370.

11733 Quantized Meson Field in a Classical Gravitational Field. The behavior of a quantized meson field in a classical gravitational field is examined. Physical quantities such as the expectation value for the number of created mesons are represented in terms of a formal Green's function. They are computed explicitly for the case of a special space-independent gravitational field. ***Tsutomu Imamura.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1430-1434.

11734 Gamma Rays From Deuteron Stripping Reactions. The distorted-wave Born approximation is used to calculate the p-γ angular correlation from several deuteron-stripping (d,p) reactions. One $l = 2$ and four $l = 1$ captures are considered. Optical potentials with rounded edges are used to distort the wave functions. In some cases the correlation is considerably changed from the pattern predicted by the plane wave Born approximation, and the distortion effects are strongly dependent on the direction of the emitted proton, and on the type of distortion assumed. ***C. R. Satchler and W. Tobocman.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1566-1574.

11735 Studies of Low-Lying Levels of Even-Even Nuclei With (d,p) and (d,t) Reactions. The relative cross sections for exciting ground states (G) bear little relationship to whether they are allowed or forbidden by the simple Mayer-Jensen configurations, so that configuration mixing is generally large. In Pd^{104}, Pd^{108}, Pt^{194}, and Pt^{196}, searches for the triplet in second excited states indicate that its total spacing must be less than 80 kev. New states were found in the triplet region of Cd^{114} and Cd^{112} bringing the total number of known states in these to 5 and 4, respectively; each includes two 0+ and two 2+ states. ***Bernard L. Cohen and Robert E. Price.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1582-1590.

11736 Spins and Decay Modes of Certain Neutron-Deficient Silver Isotopes. Isotopically enriched Pd foils were bombarded with protons to determine the origin of the 1.2-hr activity which was previously discovered in an even-A Ag isotope. The only appropriate activity was found in Ag^{104} which was observed to have a (69 ± 3)-min predominantly K-capture activity with intense γ rays of 550, 764, and 920 kev. The $I = 2$ resonance in Ag^{104}, when counted in an X-ray detector, was found to decay with a 69-min half-life with a small admixture of a 27-min component. ***O. Ames, A. M. Bernstein, M. H. Brennan, R. A. Haberstroh, and D. R. Hamilton.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1599-1604.

11737* Formulas in the Fermi Theory of Beta Decay. II. On the Beta Ray Angular Correlation. Formulas are given for the allowed and the first forbidden beta-gamma angular correlations including polarization of the gamma ray, and the second forbidden beta-gamma directional correlation where the mixed interaction of vector and axial vector types (VA) and the nonconservation of parity in beta decay is assumed. Since these formulas for the allowed and the first forbidden transitions have already been given by Morita (M.) and Morita (R. S.) for the case of the point nuclear charge, they are only rewritten in this paper. ***Zyun-itiro Matumoto.*** *Progress of Theoretical Physics*, v. 23, no. 4, Apr. 1960, p. 531-561.

11738* S-Wave Pion-Σ-Hyperon Scattering. Qualitative character of the S-wave pion-Σ-hyperon scattering is investigated, comparing with the corresponding S-wave pion-nucleon scattering. Information on S-wave pion-Σ-hyperon scattering is obtained from K^- capture experiments which have suggested large magnitudes of the phase shifts as well as large isotopic spin dependence. It is pointed out that these characteristics seem to be explained only when doublet approximation proposed by A. Pais is abandoned. ***Ken Kawarabayashi and Tetsuo Sawada.*** *Progress of Theoretical Physics*, v. 23, no. 4, Apr. 1960, p. 583-596.

11739* Photodisintegration of the Deuteron in the High Energy Range. The differential and total cross sections for the photodisintegration of the deuteron are calculated for the incident photon energies in the range from 80 Mev to 300 Mev. For the initial state, the pion-theoretical deuteron wave function which has almost 7% of D-state mixture is adopted. The plane wave is used for the final state. It is shown that the

excitation function agrees with the observed data in the energy range, if the meson effects are added to the result. ***Masahiko Matsumoto.*** *Progress of Theoretical Physics*, v. 23, no. 4, Apr. 1960, p. 597-609.

11740* Mass Levels of Baryons and Mesons. Investigates the relation between the observed mass levels of baryons and mesons as well as the resonance levels in pion-nucleon and kaon-nucleon reactions and the various configurations of particle states derived from Ikeda-Ogawa-Ohnuki's symmetry theory which is based on Sakata's composite particle model. It is found that there is a close correspondence between the theoretical levels and the experimental evidence. ***Shoji Sawada and Minoru Yonekawa.*** *Progress of Theoretical Physics*, v. 23, no. 4, Apr. 1960, p. 662-693.

11741* On the Meson Mass Differences. In view of the recent experimental evidence indicating $m_{k^0} > m_{k^+}$, in contrast with the well established result in $m_{\pi^+} > m_{\pi^0}$, the problem of the electromagnetic meson self-masses is reinvestigated. A semi-phenomenological approach is used by the introduction of a nonlocal effective interaction hamiltonian, gage invariant up to the order e^2, where new terms corresponding to one-photon and two-photon vertices are considered, to take into account the effects of the strong interactions. ***Gerhard Wilhelm Bund and Paulo Leal Ferreira.*** *Progress of Theoretical Physics*, v. 23, no. 4, Apr. 1960, p. 700-716.

11742 Radioactive Fallout Data. During the past few years 11 installations associated with the United States Atomic Energy Commission have participated in monitoring radioactive fallout during periods of United States nuclear weapons testing at the Eniwetok Proving Ground and the Nevada Test Site. These data have been drawn together for the period covering the United States tests during 1958. ***Gordon M. Dunning, editor.*** 107 pp. 1959. U. S. Atomic Energy Commission, Washington, D. C. (UF767 Un3.1rd)

11743* Calculation of Cherenkov Radiator in the Microwave Region. The wave guided Cherenkov radiator is calculated for relativistic, grouped electron beams in the microwave region. It is shown that the wave guided construction of the radiator guarantees a considerably higher capacity of radiation than shown by data obtained from calculations for an infinite dielectric medium with a channel for the passing through of a beam. The dependence of the resistance of the radiation on the wavelength, on the cross-section dimensions of the cylindrical wave guide, and on the channel in the dielectric is investigated, as well as the dependence on the dielectric penetrability of the retarding medium. (*In Russian.*) Raschet cherenkovskogo izluchatelia v diapozone SV Ch. ***L. G. Lomize.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 707-719.

11744 Nuclear Properties of Antinucleons. The study of antiprotons reveals other antiparticles previously predicted and also unpredictable aspects of the scattering and annihilation process. ***Emilio Segrè.*** *Science*, v. 132, July 1, 1960, p. 9-14.

11745 Heavy-Water-Moderated Power Reactors. A Status Report. Cost estimates show that a pressure tube reactor cooled by boiling D_2O offers the most promise of eventually producing competitive electric power of any of the various D_2O-cooled-and-moderated reactor systems that have been studied to date. It is estimated that a boiling reactor fueled with natural U could produce power for about 9 mills/kwh in a 300 MW_e plant and for about 10 mills/kwh in a 200 MW_e plant. In order to attain completely competitive power cost, the fuel cycle cost must be made lower than the cost of either fossil fuel or the enriched U fuel used in other types of power reactors. It is concluded that first priority should be given to development work aimed at determining whether the fuel cycle cost in a full-scale reactor can be reduced to 1 mill/kwh, and preferably to an even lower value. ***D. F. Babcock, et al.*** *U. S. Atomic Energy Commission, DP-480*, Mar. 1960, 60 pp. (UF767 Un3.1dp Contin.)

11746 Pyrophoricity of Uranium in Reactor Environments. Experience at Hanford reactors suggests three conditions which tend to reduce the fuel element fire hazard, namely: minimizing of the in-core residence time of a fuel element with a cladding defect which permits U corrosion, employment of removal and discharge techniques which do not contribute to the deterioration of the fuel element, and minimizing of the time interval between discharge and entry into the retention basin. Helium, and to a lesser extent CO_2, have demonstrated utility in inhibiting and quenching U fires. ***G. E. Zima.*** *U. S. Atomic Energy Commission, HW-62442*, Jan. 22, 1960, 74 pp. (UF767 Un3.1hw Contin.)

11747 Design Considerations for a Plasma Thermocouple Reactor. General features of a nuclear reactor-plasma thermocouple power system are investigated. Only simple plasma cells are considered, for which all the experimental data and most of the theory have been presented elsewhere. From the available information, it is concluded that the reactor should be a heterogeneous system alternating hot junctions (reactor fuel) and cold junctions (liquid metal coolant preferred) and must contain a large number of cells. ***Bob E. Watt.*** *U. S. Atomic Energy Commission, LAMS-2386*, Jan. 15, 1960, 24 pp. (UF767 Un3.1La Contin.)

11748 Carbide Fuel Development. A combination of UC and PuC is proposed as a fuel which has the potential for reducing the fuel-cycle cost of fast breeder reactors. A 3½-year development program is outlined, the purpose of which is to fabricate the fuel and evaluate the fuel properties having the most significant effect on fuel cycle cost. Technical progress in the first four months of Phase I consisted of: conceptual design, plutonium facility design, fuel fabrication and evaluation, and reprocessing. ***A. Strasser.*** *U. S. Atomic Energy Commission, NDA-2140-2*, Oct. 15, 1959, 100 pp. (UF767 Un3.1nd Contin.)

11749 Dimensional Instability of Uranium. IV. Several experiments were performed in order to provide experimental basis for the diffusional theory of the dimensional instability of U. Alpha-uranium rods possessing a constant preferred orientation but varying grain size were irradiated in the MTR. No significant effect of grain size on irradiation-induced growth could be detected. ***R. Resnick, L. S. Castleman, and L. Seigle.*** *U. S. Atomic Energy Commission, SEP-255*, Feb. 1960, 26 pp. (UF767 Un3.1se Contin.)

11750 Useful Energy From Atomic Nuclei. Introduction to the Physics and Technics of Nuclear Reactor and Atomic Power Plant. Covers such areas of nuclear science as effects of radiation; sanitary protection; radiation screening; adjustment techniques in the operation of thermal reactors, of nuclear reactors, and atomic plants; special chemical problems connected with the recombination of products of disintegration; combination technique of nuclear energy installation; fuel problems; economics; organization; and legal questions. (*In German.*) Nutzenergie Aus Atomkernen. Einführung in Physik und Technik von Kernreaktor und Atomkraftwerk. ***Karl Rudolf Schmidt.*** 741 pp. + 6 plates. 1960. Walter De Gruyter & Co., Berlin. (TK9145 Sch54n)

11751* Protection From Enclosed Sources of Radiation. Protective walls of varying thickness are required to provide protection from β and α rays—depending on the radiant energy. This thickness must be so rated to take account of the activity of the radiators and their distance from personnel to ensure that the permissible dose rate for the latter is not exceeded. Protection from X-radiation has also to be taken into consideration in the case of beta radiators. (*In German.*) Strahlenschutz vor geschlossenen Strahlenquellen. ***R. Plesch.*** *VDI Zeitschrift*, v. 102, no. 17, June 11, 1960, p. 685-689.

11752* Considerations Concerning the Planning of a Magnetic Atomic-Ray Resonance Apparatus. A method for the calculation of the most suitable dimensions in the construction of a high-intensity atomic-ray resonance apparatus with the usual two wire field and an electron impact ionization detector is described. An apparatus with three times as high inhomogeneity releases only a 40% larger signal to the detector. (*In German.*) Überlegungen zur Planung einer magnetischen Atomstrahlresonanzapparatur. ***Dieter von Ehrenstein, Gerhard Fricke, and Peter Pietsch.*** *Zeitschrift für Angewandte Physik*, v. 12, no. 5, May 1960, p. 193-202.

11753* Isotope Concentration in Bromine by Electrolytic Transfer in Molten Zinc Bromide. The mass effect (relative difference of the migration velocity/relative difference of the masses) was $\mu = -0.035 \pm 0.002$. In the four halides of bivalent metals investigated, the mass effects of the anions of the equation $\mu = -0.054(1+m^-/2.2m^+)^{-1}$ are sufficient. This equation is compared with equation for the mass effect of the cations.

(*In German.*) Isotopenanreicherung bei Brom Durch elektrolytische Überführung in geschmolzenem Zinkbromid. ***A. Lundén and A. Lodding.*** *Zeitschrift für Naturforschung*, v. 15a, Apr. 1960, p. 320-322.

11754* The Hyperfine Structure Separation of the Ground-state $^2S_{1/2}$ and the Nuclear Magnetic Dipole Moment of Gold^{197}. A special high-frequency arrangement is described. The hyperfine structure separation $\Delta\upsilon$ was determined from $\Delta F = 1$ transitions. The magnetic dipole moment μ_I was measured by a direct method. (*In German.*) Die Hyperfeinstrukturaufspaltung des Grundzustandes $^2S_{1/2}$ und das magnetische Kerndipolmoment von Au^{197}. ***Ekkehard Recknagel.*** *Zeitschrift für Physik*, v. 159, no. 1, 1960, p. 19-32.

11755* Elastic and Inelastic Distribution of Deuterons on Aluminum at 11.8 MeV. Separation of the deuterons from other products of the deuteron reactions was accomplished by recording dE/dx, measured by a three-fold proportional counter, and E, measured by a CsI-counter, on an oscilloscope screen. The experimental inelastic angular distributions have the shape of a direct interaction process. The elastic angular distribution shows pronounced diffraction maxima. (*In German.*) Elastische und unelastische Streuung von Deuteronen an Aluminium bei 11.8 MeV. ***A. Doehring, R. Jahr, and U. Schmidt-Rohr.*** *Zeitschrift für Physik*, v. 159, no. 2, 1960, p. 149-154.

11756* Nuclear Disintegrations in a Photographic Emulsion Produced by 930 MeV Protons. Interaction between 930 MeV protons and photographic emulsion nuclei was investigated, special attention being directed to interactions involving the emission of multicharged particles with $Z \geq 3$ from nuclei. The relative yield of H, He, and Li nuclei and also nuclei with $Z \geq 4$ has been determined for light and heavy nuclei disintegrations with ≥ 3 prongs. For Ag, Br disintegrations, the cross section for lithium isotope production was found to equal $(135 \pm \pm 31)mb$ and the cross section for production of fragments with $Z \geq 4$ was found to equal (62 ± 11) *mb*. Angular and energy distribtuions of the fragments, multiplicity of fragment production, dependence of the probability of fragment production on the number of α-particles and protons in the disintegration and other fragmentation characteristics have been determined. The fragmentation mechanism is discussed. (*In Russian.*) Iadernye rasshchepleniia v fotoemul'sii, vyzyvaemye protonami s energieĭ 930 MeV. ***O. V. Lozhkin, N. A. Perfilov, A. A. Rimsky-Korsakov, and J. Fremlin.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1388-1398.

11757* Angular Distributions of 6.8 MeV Protons Elastically Scattered on Chromium, Nickel and Copper Isotopes. The angular distributions of 6.8 MeV protons elastically scattered on Cr^{52}, ^{53}, Ni^{58}, ^{60}, ^{62}, and Cu^{63}, ^{65} isotopes were investigated. Appreciable differences in the variation of the differential cross sections were found in the various isotopes. The results indicate that in scattering studies, account should be made of the individual features of the nuclei. (*In Russian.*) Uglovye raspredeleniia uprugo rasseiannykh protonov s energieĭ 6.8 MeV na izotopakh khroma, nikel'ia i medi. ***A. K. Valter, et al.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1419-1423.

11758* Investigation of α-Decay of U^{230}. An ionization chamber with a grid was employed to investigate the α-spectrum of U^{230}. After introduction of corrections to account for ionization, imperfect grid shielding, and rise time of the pulse, the energy of the fundamental α-particle group was found to be (4.488 ± 0.003) MeV. The energies and intensities of transitions to the 2^+ and 4^+ levels of the daughter nucleus have also been determined. (*In Russian.*) Issledovanie α-raspada U^{230}. ***A. P. Komar, G. A. Korolyov, and G. E. Kocharov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1436-1438.

11759* Elastic Scattering of 8.5 BeV Protons on Protons. Elastic *pp*-scattering at an energy of 8.5 BeV was studied by the photographic emulsion technique. The irradiation geometry employed was such that the incident proton beam was directed perpendicular to the photographic emulsion plane. One hundred and forty-five elastic scattering events were detected of which 66 have been previously published. The contribution of scattering on quasi-free protons and of other "background" events comprise ~1%. The total elastic scattering cross section equal to (8.6 ± 0.8) *mb* and also the differential cross section down to 1° in the c.m.s. have been obtained. The results can be made consistent with the homogeneous semitransparent ball model with a refractive index not equal to unity. (*In Russian.*) Izuchemie uprugago rasseianiia protona na protone pri energii 8.5 BeV. ***P. K. Markov, E. N. Tsyganov, M. G. Shafranova, and B. A. Shakhbazian.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1471-1475.

11760* Investigation of the Spectra of Neutrons Emitted in the Disintegration of Deuterons by Protons. The energy spectra of neutrons emitted at angles of 0° and 180° in the c.m.s. from the $p + a \rightarrow p' + n$ reaction are calculated for a total energy of the reaction of ~4 MeV, pair interaction of nucleons in the final state being taken into account. Application of this method for calculation of the energy distributions of reaction products when several particles are emitted is considered from the standpoint of its possible application for ascertaining the role of particle interactions in the final states. (*In Russian.*) Issledovanie spektrov neĭtronov iz reaktsii raspada deĭtrona pod deĭstviem protonov. ***V. V. Komarov and A. M. Popova.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1559-1563.

11761* On Magnetic Bremsstrahlung of a Restricted Plasma. Magnetic bremsstrahlung of a high-temperature plasma located in a strong magnetic field is considered. (*In Russian.*) O magnitro-tormoznom izluchenii ogranichennoĭ plazmy. ***K. N. Stepanov and V. I. Pakhomov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1564-1568.

11762* Single-Photon Annihilation and Electron Pair Production in a Medium. Single-photon annihilation and electron pair production $e^+ + e^- \rightleftarrows \gamma$ may occur in a dispersive medium with a refractive index smaller than unity. In order for such processes to take place, the photon energy must lie in the interval $2m \leq \omega \leq N^{1/3}$, where m is the electron rest energy and N is the electron density in the medium. The probabilities for such processes are computed. The physical essence of the effect is similar to that of the Vavilov-Cherenkov effect. The processes under consideration dominate in the energy range $2m < \omega < 10m$. (*In Russian.*) Odnofotonnaia annigiliatsiia i rozhdenie elektronnykh par v srede. ***G. S. Saakian.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1593-1596.

11763* On the *D*-Mesons. The processes most favorable for the production of the D-mesons are discussed. Experiments are proposed to determine the spin and parity of the D-mesons. (*In Russian.*) K voprosu o D-mezone. ***Hsien Ding-chang.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1627-1629.

11764* Collective Excitation of Nonaxial *Even-Even* Nuclei. Collective excitation states of nonaxial even-even nuclei are investigated with account of interaction between rotational and vibrational states. (*In Russian.*) Kollektivnye vozbuzheniia neaksial'nykh chetno-chetnykh iader. ***A. A. Chaban.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1630-1636.

See also: **11457** (nuclear reactor performance); **11462** (nuclear power for space).

OPERATIONS RESEARCH

11765* The Management Training Laboratory. This is a procedure for getting members of management to relate better to each other and to their employees. From 8 to 15 trainees are brought together for about 15 to 20 two-hour sessions during the training period of one to two weeks. ***Bernard M. Bass.*** *Advanced Management*, v. 25, July 1960, p. 11-15.

11766* Advances in Human Relations Vs. Advances in Science and Technology. *W. I. McNeill.* *Advanced Management*, v. 25, July 1960, p. 16-19.

11767* **How Behavioral Scientists Can Help Business.** The behavioral sciences, with their concern for psychological and social factors that influence behavior, are establishing an important role in the business world. ***Delbert C. Miller.*** *Business Horizons*, v. 3, no. 2, Summer 1960, p. 32-37.

11768 **The Folklore of Management. VII. The Myth of the Management Committee.** ***Clarence B. Randall.*** *Dun's Review and Modern Industry*, v. 76, no. 1, July 1960, p. 37-39.

11769 **When the Computer Takes Over the Office.** All classes of jobs, from office clerk to vice president, are affected, quantitatively and qualitatively. ***Ida Russakoff Hoos.*** *Harvard Business Review*, v. 38, no. 4, July-Aug. 1960, p. 102-112.

11770* **The Logical Design of Electrical Networks Using Linear Programming Methods.** Describes the results of an investigation into the mathematical design, as distinct from analysis, of electrical power-system networks. Starting with geographical positions of the substations which it is required to interconnect, it is shown that a set of equations can be obtained which are solvable by linear-programming techniques to obtain a minimum-cost network design. ***U. G. W. Knight.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. A, no. 33, June 1960, p. 306-319.

11771 **Duality in Quadratic Programming.** A proof, based on the duality theorem of linear programming, is given for a duality theorem for a class of quadratic programs. An illustrative application is made in the theory of elastic structures. ***W. S. Dorn.*** *Quarterly of Applied Mathematics*, v. 18, no. 2, July 1960, p. 155-162.

11772* **How to Get Optimum Production—From Multiple-Machine Setups.** Minimum-cost machining conditions for any desired production rate—the optimum number of machines and the best cutting speeds—can be determined mathematically, using a general production function developed by the author. ***Roy Mennell.*** *Tool Engineer*, v. 45, no. 1, July 1960, p. 81-84.

11773 **What Are the Current and Possible Future Accomplishments by Industrial Engineering Within the Coal Industry.** Within the next ten years, industrial engineering should be just as much a part of coal production as mining engineering. ***David L. Francis.*** *West Virginia University, Technical Bulletin No.* 58, Apr. 1960, p. 62-67. (TA21 W52t Contin.)

ORE AND MATERIALS BENEFICIATION

11774 **Direct Iron Processes and Their Prospects in Eastern Canada.** Several processes are reviewed and classified, and an attempt is made to evaluate the cost of producing and marketing direct iron products. ***R. B. Elver.*** *Canada, Mines Branch, Mineral Information Bulletin MR* 41, Mar. 1960, 63 pp. (TN26 C16.55m Contin.)

11775* **Alternative Processes for the Reduction of Iron Ore.** *Coke and Gas*, v. 22, June 1960, p. 240-242.

11776 **New Vibrating Screen Improves Iron Ore Processing.** In 1958-59, Luossavaara-Kiirunavaara Co. altered its central dry cobbing plant to meet increasing demand for high-grade, iron ore-fines suitable for strand-sintering. Previously used vibratory screens were replaced by a new type, known as L-screens to permit a simple, inexpensive and efficient dry screening. ***Bengt Fagerberg.*** *Engineering and Mining Journal*, v. 161, July 1960, p. 88-91.

11777* **Sorting of the Structural Components of Mineral Coal by Flotation.** The wettability of coal is improved and the selective capacity is strengthened by addition of methanol. Thirty per cent methanol increases the separative effect by about 25% as compared with pure water as a suspension agent. The stirring time is independent from the solubility product and from the solution velocity of the reagent. For rapid recovery of a material considerably enriched with macerals, flotation combined with gravity separation is recommended. (*In German.*) Die Anreicherung von Gefügebestandteilen der Steinkohle durch Flotation. ***Carl Kröger and Erich Bade.*** *Glückauf; Bergmännische Zeitschrift*, v. 96, no. 12, June 4, 1960, p. 741-747.

11778* **Wet Screening . . . Finnish Method Eliminates Ore Buying Prior to Processing.** ***R. T. Hukki, J. Tanila, and O. Korhonen.*** *Mining World*, v. 22, no. 8, July 1960, p. 34-35.

11779* **Surface Characteristics of Alcohol Solutions.** A study of froth formation. The correlation between surface tension and froth-ability for solutions containing n-hexyl alcohol has been studied both qualitatively and quantitatively. ***Tor Notevarp.*** *Tidsskrift for Kjemi, Bergvesen og Metallurgi*, v. 20, no. 5, 1960, p. 99-106.

11780* **Complex Cobalt-Bearing Raw Materials Treated by Fuming.** A new laboratory technique was developed and tested for the complex extraction of Cu, Zn, Pb, and Co from a sulfide concentrate, which is processed with considerable difficulty by the existing pyro- and hydrometallurgical methods. Method permits the extraction of 62% Co, 94% Cu, 85% Zn, and 95% Pb. By reprocessing the Co, extraction can be increased to 76%. (*In Russian.*) Primenenie protsessa f'iumingovaniia dlia pererabotki kompleksnogo kobal'tsoderzhashchego syr'ia. ***V. V. Kostelov, B. F. Verner, and L. P. Ivanchenko.*** *Tsvetnye Metally*, v. 33, no. 6, June 1960, p. 37-42.

11781 **Controlled pH Stripping of Uranium From Amines.** A method for stripping U from amines by contacting the extract with an ammonium sulfate solution, while adjusting the pH to 3.5-4.5 with ammonium hydroxide, was developed through laboratory scale. Reagent costs are low (~7¢/lb U_3O_8) and the product is a high-assay sodium-free (or low sodium) concentrate. However, separation from Mo are relatively poor, and somewhat more careful control is required than in certain other available stripping methods. ***D. J. Crouse.*** *U. S. Atomic Energy Commission, ORNL*-2941, June 15, 1960, 26 pp. (UF767 U3o Contin.)

See also: **11098** (froth flotation).

PHYSICS

11782 **Light Diffraction by Two Distorted Ultrasonic Waves.** Investigates light intensities in the orders of diffraction patterns produced by two distorted ultrasonic waves 180° out of phase. In the case where the two waves have the same intensity, the first diffraction orders vanish. The simultaneous increase in light intensity in the second orders is a measure of the second harmonic present in the waves, given for varying distances from the transducers. ***Walter G. Mayer and E. A. Hiedemann.*** *Acoustical Society of America, Journal*, v. 32, June 1960, p. 706-708.

11783 **Parameter of Nonlinearity in Fluids.** Values of the parameter of nonlinearity for acoustics $B/A = (\rho_0/c_0^2)(a^2p/a\rho^2)_s$ are given for all liquids for which experimental data are available. The experimental data indicate that B/A generally increases slowly with temperature. Presents a method of computing B/A directly from finite-amplitude acoustic measurements. ***Robert T. Beyer.*** *Acoustical Society of American, Journal*, v. 32, June 1960, p. 719-721.

11784* **Exchange Interaction of Inner and Outer Electrons in Transition Metals.** Calculations revealed an effective (indirect) exchange link between the inner electrons. This interaction has the character of a ferromagnetic link and thus, in the absence of a direct d-d-exchange of inner electrons, can only result in ferromagnetism. In general, the indirect interaction through the conductivity electrons leads only to the renormalization of the exchange integral and does not qualitatively change the spectrum of the energy of the spin wave. (*In Russian.*) Ob obmennom vzaimodeĭstvii vnutrennikh i vneshnikh elektronov v perekhodnykh metallakh. ***A. A. Berdyshev, Iu. A. Izium ov, B. V. Karpenko, and Iu. Ia. Poliak.*** *Akademiia Nauk SSSR, Doklady*, v. 132, no. 4, June 1960, p. 797-800.

11785* On the Theory of Unbalanced Capture of Admixtures During Crystal Growth. The coeffiicent of capture of the admixture was calculated according to the following assumptions: the crystal increases at the expense of the subsequent deposition on its surface of new layers of a substance of the same thickness and through different time intervals. The speed of displacement of the degrees by which these layers terminate is high in comparison with the speed of diffusion of the admixture in the crystal. (*In Russian.*) K teorii neravnovesnogo zakhvata primeseĭ pri roste kristallov. ***A. A. Chernov.*** *Akademiia Nauk SSSR, Doklady,* v. 132, no. 4, June 1960, p. 818-821.

11786* Spectra of Combination Dispersion and Structure of Hydrocarbons. Study covers experimental methods used in determining the real values of intensity of the width and shapes of combination dispersion lines and of their depolarization, the spectra of combination dispersion of paraffins with different types of C atoms, of naphthenes, of unsaturated hydrocarbons, the tensor of derivative polarizability, and the parameters of the lines of combination dispersion. (*In Russian.*) Spektry kombinatsionnogo rasseianiia i stroenie uglevodorodov. ***M. M. Sushchinskiĭ.*** *Akademiia Nauk SSSR, Fizicheskĭ Institut, Trudy,* v. 12, 1960, p. 54-224 + 1 plate.

11787* Study and Production of an Elastic Base With Variable Stiffness for the Insulation of Vibrations. Characteristics of nonlinear elasticity of the rubber selected and the special curved shape of the supports resulted in a suitable insulation of the vibrations for the posts of the working shop existing above combustion laboratories, without causing any excessive deflection when the normal load of the posts was multiplied by five during the passage of a rolling charge. (*In French.*) Etude et realisation d'une base elastique a raideur variable pour isolement des vibrations. ***Pierre Lienard.*** *Annales des Telecommunications,* v. 15, nos. 3-4, Mar.-Apr. 1960, p. 61-70.

11788* A Spinor Approach to General Relativity. A calculus for general relativity is developed in which the basic role of tensors is taken over by spinors. The Riemann-Christoffel tensor is written in a spinor form according to a scheme of Witten. It is shown that the curvature of empty space can be uniquely characterized by a totally symmetric four-index spinor which satisfies a first-order equation formally identical with one for a zero rest-mass particle of Spin Two. However, the derivatives used here are covariant, so that on iteration, instead of the usual wave equation, a nonlinear "source" term appears. The case when a source-free electromagnetic field is present is also considered. ***Roger Penrose.*** *Annals of Physics,* v. 10, June 1960, p. 171-201.

11789* Hydromagnetic Stability of a Diffuse Linear Pinch. The hydromagnetic energy principle is applied to the derivation of necessary and sufficient conditions for the hydromagnetic stability of a linear pinch with distributed plasma current. The results are quite general in that the axial and azimuthal components of the magnetic field, which determine the structure of the pinch completely, are treated as arbitrary functions of distance from the axis. ***William A. Newcomb.*** *Annals of Physics,* v. 10, June 1960, p. 232-267.

11790* Diamond. II. Reviews some recent solid-state physics studies made on diamond. These include both the ultraviolet and the infrared absorption spectra of diamond; classification; survey of the semi-conducting properties exhibited by some diamonds; luminescence; and some of the effects produced when diamonds are subjected to irradiation by high-energy particles and by neutrons. ***S. Tolansky.*** *Contemporary Physics,* v. 1, no. 4, Apr. 1960, p. 276-286.

11791* Primary Cells. Describes systems of the Leclanché, Mg and R.M. (Hg) cells, together with the lesser-known air depolarized and reserve type cells. Nuclear cells are still in the development stage and will be used for specialized applications only. Fuel cells are of great interest to the electrical engineer. ***D. Naylor.*** *Contemporary Physics,* v. 1, no. 4, Apr. 1960, p. 287-303.

11792* Cryogenic Data Book. WADC Technical Report 59-8. A compilation of the physical properties of several liquefied gases and a number of structural and thermal insulating materials in the temperature region of liquefied gases are presented. Specifically, the liquefied gases treated are He, H (para and ortho), H deuterids, deuterium, N, O, and air. ***Dudley B. Chelton and Douglas B. Mann.*** 144 pp. 1959. U. S. Air Force. Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. (QC278 Un3.18c Ref.)

11793 On the Physical Characteristics and Chemical Composition of Electroluminescent Phosphors. Through controlled removal of surface layers, it was found that surface chemical barriers are not responsible for electroluminescence in zinc sulfide phosphors. Polycrystalline phosphors are shown to be almost uniform with respect to chemical, physical, and electroluminescent properties as one passes from the surface into the crystallite bulk. ***Paul Goldberg and S. Faria.*** *Electrochemical Society, Journal,* v. 107, June 1960, p. 521-526.

11794 Using Nuclear Resonance to Sense Temperature. The r-f energy that a chlorine molecule absorbs depends on its temperature. Principle is used in designing a new instrument for temperature telemetry. ***Christopher Dean.*** *Electronics,* v. 33, no. 28, July 8, 1960, p. 52-54.

11795* Heat Transfer by Radiation in a Laminated Medium. Heat transfer by radiation in a laminated medium is calculated on the assumption that heat conduction and convection can be neglected. There are made calculations for different values of total emissivity and the amount of transferred energy per unit of area and time is derived. It is to be seen that the temperature distribution does not depend on special assumptions. (*In German.*) Wärmeübergang durch Strahlung in einem geschichteten Medium. ***G. Bauer.*** *Elektrowärme,* v. 18, May 1960, p. 157-159.

11796* Theory of the Magnetic Susceptibility of Crystals. By means of a new method, an expression was derived for a field-independent magnetic susceptibility of electrons in a periodic potential. Comparison was drawn with the other existing methods. The result is easily applied to the approximations of nearly free and of closely combined electrons, and a simple interpretation is obtained. ***C. P. Enz.*** *Helvetica Physica Acta,* v. 33, no. 2, 1960, p. 89-114.

11797* The Absolute Spectral Sensitivity of Photo-Cells. Describes a method and results of measurement of absolute spectral sensitivity of Se photoelectric cells, photoelectric cells with cathodes of pure metal, Sb-Li, multi-alkali and Sb-Cs photocathodes. (*In Russian.*) Absoliutnaia spektral'naia chuvstvitel'nost' fotoelementov. ***M. N. Smolkin.*** *Inzhenerno-Fizicheskĭ Zhurnal,* v. 3, no. 6, June 1960, p. 104-106.

11798 On the Flow of a Non-Newtonian Liquid on a Rotating Disk. Equations describing the flow of a power-law non-Newtonian fluid on a rotating disk are solved in general form. This makes it possible to calculate how the shape of an initial surface contour will vary with time and to investigate the possibility of producing uniform films by applying the materials to a rapidly spinning disk. Shows that the latter process, which has potential industrial applications, has a much better chance of succeeding if the fluid is Newtonian. ***A. Acrivos, M. J. Shah, and E. E. Petersen.*** *Journal of Applied Physics,* v. 31, June 1960, p. 963-968.

11799 Mechanism of Inert Gas Cleanup in a Gaseous Discharge. An investigation has been made of the cleanup of inert gases by a gas discharge. The cleanup of rare gases in a tube in which metal is being sputtered is governed largely by two factors—the rate at which the metal is sputtered, and the potential of the surface on which the metal lands. At small negative or positive potentials on the surface collecting sputtered metal, there is a slow cleanup caused by uncharged species being buried by sputtered metal. At more negative potentials, burial of ions becomes important, and cleanup is much more rapid. Recovery has been effected by heating to the evaporation temperatures of the metal. As the metal evaporates, the buried gas is liberated. ***K. B. Blodgett and T. A. Vanderslice.*** *Journal of Applied Physics,* v. 31, June 1960, p. 1017-1023.

11800 Rotational Diffusion Constant of a Cylindrical Particle. The torque constant of a closed cylinder rotating in a viscous medium has been calculated for length (2a) over width (2b) ratios larger than 3.5 to within a first order in b/a. The

analysis demonstrates how the contributions to the viscous dissipation tend to be underestimated in hydrodynamic considerations so that the geometrical values deduced from them come out too high. Experimental results for the torque on cylindrical rods and ellipsoids for a/b values from 3.5 to 30 are close to the theoretical results. ***S. Broersma.*** *Journal of Chemical Physics,* v. 32, June 1960, p. 1626-1631.

11801 Relaxation of an Isolated Ensemble of Harmonic Oscillators. Discusses the collisional relaxation of an isolated ensemble of harmonic oscillators from initial nonequilibrium distributions. The "transport equation" for the relaxation process is derived, and it is shown that it can be linearized even though the relaxation takes place via binary oscillator collisions. The final, stationary distribution is found to be a Boltzmann one with a temperature uniquely defined by the mean energy of the ensemble. ***Kurt E. Shuler.*** *Journal of Chemical Physics,* v. 32, June 1960, p. 1692-1697.

11802 Calculation of Delocalization Contribution to Infrared Intensity. Infrared intensity may be related to energies and intensities of electronic transitions by using the theory of the vibrational perturbation of electronic transitions and holding the electronic state quantum number fixed. This suggests in particular relating the infrared intensity of an appropriate normal mode to the strong ultraviolet absorption in dye-like molecules having conjugated π-electron systems. The perturbation theory is tested by applying it to a displaced H atom and the H molecule ion. ***Walter D. Jones and William T. Simpson.*** *Journal of Chemical Physics,* v. 32, June 1960, p. 1747-1756.

11803 Rotation-Vibration Interaction in Electronic Transitions. Application to Rotational "Temperature" Measurements. The effect of rotation-vibration interaction on line intensities in electronic transitions in diatomic molecules is discussed. Shows that this effect is closely related to the variation in the electronic transition moment with internuclear distance. The relation of this to the determination of rotational temperatures is discussed, using the OH radical as an example. ***Thomas C. James.*** *Journal of Chemical Physics,* v. 32, June 1960, p. 1770-1775.

11804 Brownian Motion in Liquids. The time derivative of the frictional force acting on a single molecule derived by Collins and Raffel was ambiguous with respect to a sign which left uncertain whether the calculated ensemble average velocity would decay exponentially in time or be initially sinusoidal in behavior. This point is now resolved and the exponential decay of the velocity is obtained for a molecule relaxing for an initial steady state. The frictional coefficient is also obtained by an alternative method. ***Gerald Mandel and Frank C. Collins.*** *Journal of Chemical Physics,* v. 32, June 1960, p. 1796-1801.

11805* Linearized Plasma Oscillations in Arbitrary Electron Velocity Distributions. A mathematical examination of the linearized small disturbances in the steady distribution $f_0(q)$ of the velocities q of the electrons in an electrostatic, collisionless plasma with motionless protons. ***George Backus.*** *Journal of Mathematical Physics,* v. 1, no. 3, May-June 1960, p. 178-191.

11806* Intensities of Rotation Lines in Absorption Bands for Symmetric Molecules of the Type AB...XYZ_3. The interaction of vibration and rotation is considered in the computation of the intensities of rotational lines in the band spectra of the general polyatomic molecule. The calculation utilizes the contact transformation method outlined in an earlier paper by the authors. The general result through first order of approximation is then applied to the case of the axially asymmetric molecule of the Type AB–XYZ_3. ***Harvey M. Hansen and Harald H. Nielsen.*** *Journal of Molecular Spectroscopy,* v. 4, no. 6, June 1960, p. 468-476.

11807* On the Theory of the Resonance Raman Effect. An equation has been advanced by Shorygin to relate the intensity of a Raman band in the resonance region to the properties of the ground and a single excited electronic level and to the frequency of the exciting radiation. A prediction of this equation that, for a molecule with nondegenerate ground and excited electronics states, the depolarization ratio must be 0.50, has been verified for four substituted aromatic nitro compounds, which have isolated intense absorption bands in the near ultraviolet. ***D. G. Rea.*** *Journal of Molecular Spectroscopy,* v. 4, no. 6, June 1960, p. 499-506.

11808* Inhomogeneous Magnetic Fields for the Focusing of the Diverging Beam of Charged Particles. The general condition for ideal focusing of plane beam of charged particles was obtained in the form of non-linear integral equation, the solution of this equation being found. The type of magnetic field which makes it possible to avoid numerical integration is given, the calculations for one particular case being made. (*In Russian.*) Neodnorodnye magnitnye polia dlia fokusirovki raskhodiashchegosia puchka zariazhennykh chastits. ***V. R. Saulit and V. A. Unt.*** *Leningrad. Universitet. Vestnik,* v. 15, no. 10, 1960, p. 28-33.

11809* Spectrometer for Nuclear Magnetic Resonance in Intermediate Fields. Magnetic field up to 200 oersteds is created by a solenoid, the inhomogeneity being compensated by two coaxial coils. The resonance lines were observed by means of a circuit with a fully balanced and a r.f. phase sensitive detector. A resolution about 7 cps at 35 oersteds is achieved, the sensitivity reaching the theoretical value for this resolution. (*In Russian.*) Spektrometr dlia iadernogo magnitnogo rezonansa v promezhutochnykh poliakh. ***V. V. Frolov.*** *Leningrad. Universitet. Vestnik,* v. 15, no. 10, 1960, p. 49-54.

11810* Steady-State Luminescence of Phosphors in the Presence of Several Kinds of Traps. The kinetics of phosphorescence for steady state excitation are studied in the case when the traps differ very markedly only in depth and are occupied to only a slight extent. Under these conditions, we can accurately calculate the distribution of charges among traps, and the nature of the dependence of this distribution, the brightness of luminescence of individual bands, and photoconductivity on temperature. ***V. V. Antonov-Romanovskii.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 8, no. 1, Jan. 1960, p. 35-39.

11811* The Influence of Secondary Absorption and Emission Processes on the Duration of Luminescence of a Plane-Parallel Layer. Formulas obtained during the investigation make it possible to calculate the duration of luminescence under different conditions of irradiation and observation. There may be a considerable increase in the duration associated with high values of the quantum yield. The duration of the luminescence as observed through the layer is always greater than the corresponding duration observed by "reflection." ***A. M. Samson.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 8, no. 1, Jan. 1960, p. 43-47.

11812* Determination of the Size of Particles by the Scattering of Light. 1. Formulas and Nomograms for Computation of Radius of Particles by the Optical Density and by Intensity of Scattered Light. On the basis on the equations of Shifrin's theory of light-scattering, formulas are derived and nomograms constructed for the determination of the sizes of particles of the dispersion systems, in which electrical properties of the particles deviate little from the properties of the surrounding medium. ***I. Ya. Slonim.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 8, no. 1, Jan. 1960, p. 48-52.

11813* New Variant of the Metallic Model of a Molecule. A model of molecules with short chains of conjugate bonds is proposed. The molecular skeleton, which consists of the nuclei and the O-electrons, is represented by a rigid charge evenly distributed along a straight line which is the same length as the conjugate bond chain. The motion of π-electrons in the field of this model of the skeleton is examined. Calculated wavelengths of absorption bands are found to be in good agreement with experimental data. ***L. A. Borovinskii.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 8, no. 2, Feb. 1960, p. 99-102.

11814* Peltier Effect and Thermal-Conductivity Measurement Techniques for Thermoelectric Materials. This selective bibliography covers the period 1950-1958. The literature of

particular interest is that of the Peltier, Seebeck, and Joule-Thompson Effects as well as certain studies of thermal conductivity. The tellurides, in particular lead telluride, was the only thermoelectric material designated as being of primary interest. ***Kenneth D. Carroll, editor.*** 136 pp. 1959. Lockheed Aircraft Corp., Sunnyvale, Calif. (ZQC621 L81.5p Ref.)

11815 Infrared Phenomena in Quantum Electrodynamics. I. The Physical One-Electron States in the Infrared Region. II. Bremsstrahlung and Compton Scattering. In view of remaining obscurities and difficulties in existing treatments of the infrared divergences in quantum electrodynamics, this problem has been considered anew. The approximate model introduced in 1937 by Bloch and Nordsieck is rediscussed. It is explicitly shown to be a good substitute for the complete theory as long as one is restricted to infrared radiation. The effects of vacuum polarization and charge renormalization require special attention. The infrared aspects of quantum electrodynamics are discussed by treating two examples of scattering processes, Bremsstrahlung and Compton scattering. A noncovariant diagram technique is used, which gives very clear insight in the cancelling of infrared divergences between real and virtual photons. The treatment of Compton scattering shows the necessity of reformulating a theorem of Thirring on the validity of the Thomson scattering formula at very low energies. ***W. Van Haeringen.*** *Physica*, v. 26, May 1960, p. 289-325.

11816 On the Asymptotic Growth Rate of Vapour Bubbles in Superheated Binary Liquid Mixtures. Growth of vapor bubbles in boiling liquid mixtures is slowed down by the difference between the vapor composition and the liquid composition if the constituents of the mixture have different volatilities. As the more volatile component is more rapidly exhausted in the liquid near a vapor bubble than the less volatile component, the growth rate of the bubble depends on the supply of the more volatile component by diffusion. ***P. J. Bruijn.*** *Physica*, v. 26, May 1960, p. 326-334.

11817 Nuclear Magnetic Resonance in Paramagnetic FeF_2. A nuclear magnetic resonance study of F^{19} resonance in paramagnetic FeF_2 is reported. The hyperfine interactions with the magnetic electrons are measured and shown to be important in determining the resonance properties. The isotropic hyperfine interaction indicates the presence of $(0.46\pm0.03)\%$ unpaired $2s$ spins in F^- orbitals from each Fe^{++} ion neighbor. ***J. W. Stout and R. G. Shulman.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1136-1141.

11818 Colloids in Additively Colored Sodium Chloride. Both natural and synthetic single crystals were additively colored by heating in a vapor of Na and by injecting electrons from a point cathode. Subsequent irradiation with ultraviolet light and heating of the synthetic crystals produced an absorbing type colloid throughout the crystal. The same treatment applied to the natural crystals produced F centers throughout the bulk of the crystal and absorbing type colloid specks at localized points in the crystal. ***H. W. Etzel.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1150-1153.

11819 Effect of Crystalline Fields on Charge Densities and Magnetic Form Factors. It is shown that the crystalline field has two effects on the free ion $3d$ wave functions, and hence on expansion of the $t_{2g}(e_g)$ orbitals and a contraction of the $e_g(t_{2g})$ orbitals resulting in two different radial charge densities, and a net expansion of the charge distribution for the free ion value. ***A. J. Freeman and R. E. Watson.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1168-1172.

11820 Surface Magnetostatic Modes and Surface Spin Waves. Examination of the spatial configuration of the magnetostatic modes of a ferromagnetic body shows that those modes whose frequency lies between $\omega = \gamma(B_1H_1)^{\frac{1}{2}}$ and $\omega = \gamma(H_1+2\pi M)$ are surface modes. It is also found that the complete spin-wave spectrum consists of a set of surface spin waves in addition to the spin-wave band usually considered. The magnetostatic mode spectrum thus merges smoothly into the spin-wave spectrum. ***J. R. Eshbach and R. W. Damon.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1208-1210.

11821 Electrical Conductivity of X-Irradiated KCl. The conductivity of Harshaw KCl crystals has been measured isothermally as a function of time in the temperature range 150-200 C, after exposing the crystals at room temperature to X-ray doses sufficient to produce about $10^{18}F$ centers/cm^3. Besides the F band, a V band at about 5.75 ev is produced. If the F band is eliminated by optical bleaching before the measurement but the V band remains, the conductivity increases monotonically to an asymptotic value. ***R. W. Christy and E. Fukushima.*** *Physical Review*, v. 118, 2nd ser., no. 5, June 1, 1960, p. 1222-1225.

11822 Ionic Conductivity of Highly Ionized Plasmas. When a cloud of highly ionized gas ejected by a plasma shock tube is made to travel across a constant magnetic field, an electromotive force is produced in the plasma in a direction normal to both the field and the plasma path. Using two probes facing one another, this electromotive force has been measured with an oscillograph. Its maximum value was found to be proportional to the field and the probe separation. ***M. Sakuntala, A. von Engel, and R. G. Fowler.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1459-1465.

11823 Generalization of Quantum Mechanics. The possibility of generalizing quantum mechanics in such a way as to retain its predictive results, while comprehending additional solutions, is examined. It is found that this can be done through a perfected formal correspondence with Hamilton-Jacobi mechanics, by which one is led to consider generalizations of the Heisenberg postulate of the form $p_jq_i - q_ip_k = S\delta_{jk}$, where S is a quantum analog of Hamilton's principal function. ***T. E. Phipps, Jr.*** *Physical Review*, v. 118, 2nd ser., no. 6, June 15, 1960, p. 1653-1658.

11824 Determining Focal Length of a Thick Lens. A simple method of finding "principal points" is given for engineers who do occasional optical work without access to optical equipment. ***Donald H. Cronquist.*** *Product Engineering*, v. 31, no. 27, July 4, 1960, p. 49 + 1 page.

11825* Work Function of BaO Thin Films on a W Support. It is shown that the dependence of work function of BaO, which was putted on W supports, on the thickness of the layer has a monotonous character. The change of work function was investigated at various heating periods in the temperature range from 1070 to 1530 K. (*In Russian.*) Rabota vykhoda tonkikh plenok okisi bariia na vol'framvoĭ podlozhke. ***A. R. Shul'man, T. S. Kirsanova, and V. K. Pavlov.*** *Radiotekhnika i Elektronika*, v. 5, no. 5, May 1960, p. 840-848.

11826 The Theory of Space Time and Gravitation. The theory of relativity, the theory in tensor form, general tensor analysis, a formulation of relativity theory in arbitrary coordinates, the principles of the theory of gravitation, the law of gravitation and the laws of motion, approximate solutions, conservation laws, and some questions of principle are discussed in detail. ***V. Fock.*** 411 pp. 1959. Pergamon Press, New York. (QC6 F69ttr)

11827* The Overhauser Effect and Related Phenomena. A study covering the contact reciprocal action of electron and nucleus spins, the saturation of paramagnetic resonance, the Overhauser effect in the case of full saturation of all the constituents, the same effect in metals, in liquid and solid diamagnetics with paramagnetic admixtures, in paramagnetic salts and semiconductors, in alkali-halide crystals and alkali-ammonium solutions, and from the viewpoint of the general principles of statistical physics and thermodynamics. (*In Russian.*) Effekt Overkhauzera i rodstvennye iavleniia. ***G. R. Khutsishvili.*** *Uspekhi Fizicheskikh Nauk*, v. 71, no. 1, May 1960, p. 9-69.

11828* Relation Between the Structure of Exciton Zones and Natural Optical Activity of Crysals. The structure of degenerate exciton zones in uniaxial crystals is considered. Expressions are derived for the dispersion of optical acitivity due to intersection of exciton energy surfaces. (*In Russian.*) O sviazi struktury eksitonnykh zon s estestvennoĭ opticheskoĭ aktivnost'iu kristallov. ***Yu. A. Tsvirko.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 38, no. 5, May 1960, p. 1615-1619.

11829* Stability of Plasma Cylinder in High Frequency Magnetic Field. The quasi-stationary magnetic field of high frequency and sufficiently high amplitude, passing through the axes can guarantee the stability of a plasma cylinder relative to arbitrary small disturbances. The magnetic high frequency field revolving along the azimuth does not create any resistance. The problem is solved in hydrodynamic approximation. (*In Russian.*) Ob ustoĭchivosti plazmennogo tsilindra v magnitnom pole vysokoĭ chastoty. ***T. F. Volkov.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 30, no. 5, May 1960, p. 497-503.

11830* The Mechanism of Predischarge Conduction Between Electrodes in Vacuum. It is assumed that initial conduction between electrodes is caused by thermionic emission in an electric field of positive ions from the anode, and of negative ions from the cathode. This initial emission is increased by processes of repeated ion-ion and ion-electron emission on the electrodes. Conditions were produced of stability of the current of conduction and of development of an ion avalanche. Basic experimental facts agree qualitatively with the hypothesis. (*In Russian.*) K voprosu o mekhanizme predprobolnoĭ provodimosti mezhduelektrodnykh promezhutkov v vakuume. ***N. I. Ionov.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 30, no. 5, May 1960, p. 561-567.

See also: **11079** (magnetic properties of Li-Al ferrites); **11401** (sound velocity); **11402** (sound propagation).

PLASTICS

11831* Polymeric Hydrocyanic Acid. Formed by anionic polymerization of HCN in aqueous solution. Reaction proceeds via dimeric hydrocyanic acid (imino acetonitrile). At the same time, ring-closure between nitrile groups in γ-positions occurs, by which reaction the chain polymer is stabilized. The observation of the possibility of a reversible addition in high concentration to metal salts, especially noble metal salts, renders it a technically interesting compound. (*In German.*) Polymere Blausäure. ***Th. Völker.*** *Angewandte Chemie*, v. 72, no. 11, June 7, 1960, p. 379-384.

11832 Applications of Plastics Materials in the Continental Chemistry Industry. Results of a study tour for the purpose of studying on the Continent the uses of plastics materials for chemical engineering applications. ***A. G. Turner.*** *British Plastics*, v. 33, June 1960, p. 244-247.

11833* Heats of Mixing of Polyisobutylene With Some Organic Solvents. Heats of mixing were measured at 25 C with the use of a Tian-Calvet microcalorimeter. It was found that the enthalpy parameter K_0 is independent of the molecular weight of the polymer sample in the investigated molecular weight range. ***Claude Watters, Hubert Daoust, and Marcel Rinfret.*** *Canadian Journal of Chemistry*, v. 38, July 1960, p. 1087-1091.

11834 The Mechanism of Termination in the Polymerization of Acrylonitrile. Radioactive tracer technique was used to investigate the mechanism of the termination reaction in the polymerization of acrylonitrile in N,N-dimethylformamide solution at 60 C. Termination occurs by combination of radicals and disproportionation contributes to a negligible extent. ***B. E. Bailey and A. D. Jenkins.*** *Faraday Society, Transactions*, v. 56, June 1960, p. 903-906.

11835 The Coupling of Polymers. I. Size Distributions and Intrinsic Viscosities. II. Vinyl Polymers and Block Copolymers. I. ***C. H. Bamford and A. D. Jenkins.*** II. ***C. H. Bamford, A. D. Jenkins, and R. P. Wayne.*** *Faraday Society, Transactions*, v. 56, June 1960, p. 907-942.

11836 Application of the Plastics Polygrid Packing to Bio-Oxidation Towers. ***D. J. Tow, J. A. Porter, and P. H. Dutch.*** *Industrial Chemist*, v. 36, June 1960, p. 265-270.

11837* Comparative Data Concerning the Antifriction Properties of Some Plastic Materials. The effects of speed, load, type of lubricant, material and hardness of the axle on the coefficient of friction and the wear of the bearings of different plastic materials such as caprone, phenol aldehyde plastic and textolite, were studied and compared with the work of bronze, cast iron and Babbit bearings. (*In Russian.*) Sravnitel'nye dannye antifriktsionnykh svoĭstv nekotorykh plastmass. ***P. I. Zemskov and I. D. Pogorelov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Mashinostroenie*, 1960, no. 3, p. 77-81.

11838* Viscoelastic Behavior of Nylon 6-6 Monofilaments Below Room Temperature. Stress relaxation and vibrational results for nylon 6-6 at temperatures between 10 and −100 C is presented and the application of the time-temperature superposition principle to them is examined. ***B. A. Dunell, Ann A. Joanes, and R. T. B. Rye.*** *Journal of Colloid Science*, v. 15, no. 3, June 1960, p. 193-204.

11839 Preparation and Some Reactions of the Vinyl Ester of Maleopimaric Acid. Vinyl ester characterized; its reactions with alcohols and cyclohexylamine have been delineated and it has been copolymerized with vinyl acetate and vinyl chloride. ***J. B. Lewis, W. D. Lloyd, and G. W. Hedrick.*** *Journal of Organic Chemistry*, v. 25, July 1960, p. 1206-1208.

11840 Polymeric Melts. Steady-state flow properties of molten polymers and the effects of pressure on these properties, the occurrence of irregularities in extrudates, and the calculation of normal (elastic) stresses from measurement of extrudate diameters. ***A. B. Metzner, E. Lucille Carley, and I. K. Park.*** *Modern Plastics*, v. 37, no. 11, July 1960, p. 133 + 6 pages.

11841 Stabilization of Mixed Polyamides. Presents the results of experimental work conducted on five different mixed polyamide compositions. The subject of heat stability is considered in detail. ***M. M. Epstein and C. W. Hamilton.*** *Modern Plastics*, v. 37, no. 11, July 1960, p. 142 + 9 pages.

11842 Gas Bubble Formation in Irradiated Plastics and Reactor Fuels. Polymethyl methacrylate plastic in which gas was formed by gamma irradiation, was used to investigate the mechanisms of gas bubble formation and growth. Bubble formation and swelling were studied for several environments, both external and internal to the plastic-gas systems. ***G. G. Bentle.*** *Nuclear Science and Engineering*, v. 7, June 1960, p. 487-495.

11843 Emulsion Polymerisation. Emulsion polymerization is a process in which a monomer is emulsified in water and converted to a high molecular weight polymer by addition polymerization, retaining the fundamental physical state of a stable emulsion throughout. Principal advantage of a synthetic resin emulsion is that it avoids the necessity of dissolving a resin in solvents, which may be expensive, inflammable or toxic, and often a combination of all three factors. Harkins theory and a mathematical and kinetic treatment by Smith and Ewart on emulsion polymerization are discussed. ***H. Warson.*** *Paint Technology*, v. 24, June 1960, p. 19-27.

11844* Manufacturing Problems of Unsaturated Polyesters. A discussion is presented on the mechanism of reactions taking place in the formation of unsaturated polyester based resins. Heats of reaction are given for the addition on anhydrides to glycol. The influence of maleic acid isomerization into fumaric acid on the reactivity of resins and the properties of finished products were studied. (*In German.*) Probleme bei der Herstellung von ungesättigten Polyestern. ***V. Zvonar and A. Sternschuss.*** *Plaste und Kautschuk*, v. 7, May 1960, p. 228-230.

11845 Newer Methods of Polymerization. ***M. Kaufmann.*** *Plastics (London)*, v. 25, June 1960, p. 242 + 3 pages.

11846 Polymer Viscoelasticity and Liquid Structure. Mechanical properties of polymers can be measured under different boundary conditions, but all can be expressed in terms of a distribution of relaxation times. These properties are strikingly dependent on both time and temperature. A quantitative equivalence between the effects of time and temperature were established, and theoretical treatments emphasize the liquid-like character of the processes involved. ***P. Mason.*** *Research Applied in Industry*, v. 13, June 1960, p. 234-240.

11847* Melt Flow of Linear Polyethylene. Discusses the limitations of certain commonly accepted test methods and illustrates the difference that can be expected in the flow behavior of commercial high-density polyethylenes. Reviews factors affecting melt viscosity, theoretical aspects of rheology, and need for high-shear measurements. ***A. P. Metzger and C. W. Hamilton.*** *Rubber Age,* v. 87, no. 4, July 1960, p. 635-639.

11848* New Thermoplastic Copolymers. L.I.R.C. research laboratory of Italy, has developed a range of thermoplastic transparent copolymers which have been introduced commercially under the name of "Dialux". *Rubber and Plastics Age,* v. 41, June 1960, p. 643.

11849* Production of Precision Plastic Sheeting. Considers problems and various factors influencing accurate sheet gauge. ***Peter Siegel.*** *Rubber and Plastics Age,* v. 41, June 1960, p. 646-647.

11850* St. Gobain Mass Polymerisation of Vinyl Chloride. ***Leo Walter.*** *Rubber and Plastics Age,* v. 41, June 1960, p. 665.

11851* Stabilizers for PVC Compounds. Important factors from the point of view of the compounder in stabilizing PVC include: degree of plasticization, temperature of processing, processing time, reprocessing of scrap, other compounding ingredients, color stability, weathering stability, service conditions, toxicity, economic factors. Principal types of vinyl stabilizer currently in general use are lead, amines, barium-cadmium systems, barium-zinc, and the organotins. ***H. Verity Smith.*** *Rubber Journal and International Plastics,* v. 138, no. 26, June 25, 1960, p. 966 + 3 pages.

11852* Plastics at Work—Polypropylene for Plant Construction. Compares physical properties of polythene and polypropylene. Discusses methods of fabricating: bending, cutting, sawing, drilling, and welding. ***David Alexander.*** *Rubber Journal and International Plastics,* v. 139, no. 1, July 2, 1960, p. 6 + 1 page.

11853* Controlled Density Polystyrene Foam Extrusion. New extrusion process which makes possible the production of foamed plastic sheet, tubing, and rod. Its low cost, insulation, flexibility, and attractiveness can open many new markets. ***F. H. Collins.*** *SPE Journal,* v. 16, July 1960, p. 705-709.

11854* Formulation of Polyamide-Epoxy Fairing Compounds for Automobiles. ***D. E. Peerman and D. E. Floyd.*** *SPE Journal,* v. 16, July 1960, p. 717-719.

11855* New Epoxy Molding Compounds. Epoxy molding compounds are the latest addition to the thermosetting conventional molding field. On an individual property basis, there are other molding compounds which may have some equal or better properties, but from an all-around standpoint, epoxy molding compounds should be considered an important addition to the field. ***Paul E. Fina.*** *SPE Journal,* v. 16, July 1960, p. 722-723.

See also: **11095** (plastic film heat exchangers); **11225** (structure in urethane coatings); **11230** (melamine-acrylic water soluble resin).

POLLUTION AND WASTES

11856 The Chemical Analysis of Air Pollutants. Methods are arranged systematically: first, general methods for sampling as well as the procedures for the determination of air and gas volume, quantity, and velocity; second, analysis of the settled particulate matter on the one hand and the suspended particulate matter on the other; third, methods for the analysis of the gaseous and vapor contaminants of the atmosphere, including radiochemical methods. ***Morris B. Jacobs.*** v. X. 430 pp. 1960. Interscience Publishers, Inc., New York. (TD884 J15c)

11857* A Review of the Literature of 1959 on Wastewater and Water Pollution Control. ***H. Heukelekian, et al.*** *Water Pollution Control Federation, Journal,* v. 32, July 1960, p. 681-720.

RUBBER AND ELASTOMERS

11858* Input Effects During Flow of Non-Vulcanized Rubbers. A method is worked out for the experimental investigation of the flow of rubber mixtures in any section channel at temperatures to 160 C, permitting the direct observation of the pressure field established along the axis of the channel. Dimensionless input losses and pressure losses for the area of established flow are largely functions of the effective Reynolds number. An equation is offered for the calculation of dimensionless input losses. (*In Russian.*) Vkhodovye effekty pri techenii nevulkanizovannykh rezin. ***R. V. Torner.*** *Inzhenerno-Fizicheskĭ Zhurnal,* v. 3, no. 6, June 1960, p. 23-28.

11859 New Horizons in Elastic Polymers. A review of new uses for polymers. ***Harry L. Fisher.*** *Journal of Chemical Education,* v. 37, July 1960, p. 369-377.

11860* Synthesis and Properties of Vinyl Siloxane Rubber. Conditions were developed for the synthesis of ethyl vinyl dichlorosilane by the chlorination of diethyl chlorosilane and subsequent dehydrochlorination of α- and β-chlorethylethyldichlorosilanes in the presence of quinoline. Specimens of vinyl siloxane rubber (CKTB) with a different content of RC_2H_3SiO links (0.07 - 4.0 mol%) in a basic polydimethyl siloxane chain were obtained. (*In Russian.*) Sintez i svoĭstva vinilsiloksanovogo kauchuka. ***I. K. Stavitskiĭ and V. M. Svetozarova.*** *Kauchuk i Rezina,* v. 19, no. 5, May 1960, p. 1960, p. 6-11.

11861* On the Swelling Behavior of Rubbers Loaded With Reinforcing Fillers and Their Vulcanizates in Solvents. After an investigation of the relations between equilibrium swelling and cross link concentration of a vulcanizate as well as of the effect of radical acceptors on the reinforcing efficiency of fillers, the activating energy of the filler/polymer interaction is studied. It was concluded that the activating energy for carbon blacks and non-black fillers is the same, that bound rubber is a necessary preliminary stage for the reinforcing which is intensified by the crosslinking processes during vulcanization. (*In German.*) Über das Quellverhalten von mit Verstärkerfüllstoffen gemischten Kautschuken und ihren Vulkanisaten in Lösungsmitteln. ***H. Lehl.*** *Kautschuk und Gummi,* v. 13, June 1960, p. 164WT-168WT.

11862* Organotin Elastomers. High Temperature Resistance Possibilities. Discusses synthesis of alkyltin methacrylate monomers and their polymerization into rubbery materials. Compounding and vulcanization techniques were developed for the homopolymer of tributyltin methacrylate and for the copolymer of tributyltin methacrylate and dibutyltin dimethacrylate. The properties of the vulcanized elastomers were determined. The tensile strength of the vulcanized material increased approximately threefold over the unvulcanized compound even without the use of reinforcing fillers. *Rubber Journal and International Plastics,* v. 139, no. 1, July 2, 1960, p. 11-12.

SPACE HEATING AND CONDITIONING

11863 A Comparative Study of the Manufacturing Costs of Thermoelectric and Mechanical Refrigerating Systems. Increased use of thermoelectricity may in the future have applications for devices of capacities up to 200 Btu/hr, and within just a few years make available thermoelectric refrigerators of up to 4 cu ft. Offers a comparison of the manufacturing costs of these two systems which combines improved thermoelectric materials, simplified manufacturing techniques and low cost power supplies. ***D. W. Scofield, P. F. Taylor, and L. A. Staebler.*** *ASHRAE Journal,* v. 2, July 1960, p. 37-41.

11864 The Dual Solution System—A Different Approach to Air Conditioning. The dual system provides independent control within its capacity, avoids the difficulties of wet cooling coils after compressor shut off, does not require a large increase in electrical service or consumption, utilizes the same equipment for heating and cooling. ***F. H. Hibberd.*** *ASHRAE Journal*, v. 2, July 1960, p. 42-46.

11865 A Simple Solution to Completely Automatic Change-Overs in Air Conditioning Is the Three-Pipe System. In the three-pipe system we have a coil which can add heat to the cold line and a second coil which can remove heat from the hot line. ***A. I. McFarlan.*** *ASHRAE Journal*, v. 2, July 1960, p. 48-52.

11866* Mechanical Shaft Seals. Mechanical shaft seals incorporate two rings which have contact faces at right angles to a pump shaft. They overcome many problems encountered with jam-type packing. Their limitations and sources of trouble are discussed. ***Sidney Sussman.*** *Air Conditioning, Heating and Ventilating*, v. 57, July 1960, p. 61-66.

11867* Can You Safely Select Electronic Temperature Controls for Surgical Suites? The electronic sensing devices are intrinsically safe at normal operating amperage and voltage for use in hazardous locations in hospitals. Electronic sensing devices must be designed and constructed of such materials that failure will not occur at potentials less than 220 volts a-c. The control panel and the power source for the ventilating system should be connected to the emergency power supply. ***George J. Thomas.*** *Air Conditioning, Heating and Ventilating*, v. 57, July 1960, p. 67-69.

11868* Economic Evaluation of Heat Rejection Methods. A large amount of factual information is presented on the engineering economics for various methods for rejecting the heat removed from air conditioning systems. Studies are tabulated for cooling seasons of various operating hours. ***Maurice J. Wilson.*** *Air Conditioning, Heating and Ventilating*, v. 57, July 1960, p. 70-72.

11869* Will the Fan Vibrate? Fans vibrate in spite of careful selection by the system designer and the manufacturer's balancing equipment. Part four of this series helps to pinpoint the responsibility by reviewing the common causes of vibration, ways to prevent it, and what to do if vibration is excessive. ***C. J. Trickler.*** *Air Conditioning, Heating and Ventilating*, v. 57, July 1960, p. 73-76.

11870* Design and Application for Electric Heat. While at present most of the installations have been made in residences, there is a growing use of this type of heat in schools, motels and commercial installations. Covers various forms of electric heat being used, and design practices that should be followed to achieve economy of operation. ***Philip Sporn and E. R. Ambrose.*** *Air Conditioning, Heating and Ventilating*, v. 57, July 1960, p. 78-92.

11871* Packaged Heat Pumps vs. Conventional Systems. If heat loss and heat gain of your plant are nearly equal, heat pump may be an economical answer. Compares package heat pumps with built-up conventional cooling systems. ***J. Orr.*** *Air Engineering*, v. 2, no. 7, July 1960, p. 39-41.

11872 "Spot-Cooling" System Ventilates New Diesel Engine Testing Plant. After a thorough analysis of all possibilities, a design was finalized which today gives peak operating efficiency and worker comfort at low cost. ***H. W. Schiewe.*** *Heating, Piping & Air Conditioning*, v. 32, July 1960, p. 127-129.

11873 How to Design Fuel Oil Piping Systems for Direct Fired Heater Installations. Direct fired heaters for industrial plants are used either singly or in multiples. The designs of the fuel oil piping systems for these installations differ considerably. Outlines the step-by-step procedures in designing these piping systems. ***M. H. Stern.*** *Heating, Piping & Air Conditioning*, v. 32, July 1960, p. 130-133.

11874 What to Consider When Selecting Check Valves, Valve Operators and Accessories. Discusses application of check valves, selection of boiler non-return valves, use of motor operators, application of cylinder operators, and specification of accessories. ***Carl A. Dopp.*** *Heating, Piping & Air Conditioning*, v. 32, July 1960, p. 141-152.

11875 Noise Control in Buildings. Fundamentals of noise control in buildings, control of transmitted sound, elimination of noise in air conditioning and other mechanical equipment, unsolved problems in sound transmission and noise control. 136 pp. 1959. Building Research Institute, National Academy of Sciences–National Research Council, Washington, D. C. (TH1725 N21.1n)

11876 Practical Aspects of Solar Swimming Pool Heating. A sun trap, using a pool as its own heat collector, is discussed along with more conventional types of solar pool heaters. Compares solar and fossil fired heaters; suggests possibilities of a floating liquid film to effect a sun trap. ***Douglass E. Root, Jr.*** *Solar Energy*, v. 4, no. 1, Jan. 1960, p. 23-24.

11877 A Report on the Utilization of Solar Energy for Refrigeration and Air Conditioning Applications. Object is to explore possibilities of utilization of solar energy in conjunction with different systems for dehydration and cooling of air, and to endeavor to establish one which will be most suited under conditions in India. An adsorption or absorption system of dehumidification with sensible and evaporative cooling of air appears to show promise. ***J. C. Kapur.*** *Solar Energy*, v. 4, no. 1, Jan. 1960, p. 39-47.

11878* Freezing and Thawing Processes in Refrigeration Accumulators. Exact knowledge of the processes which take place in plants in which refrigeration is accumulated is indispensable for the correct dimensioning of the equipment used. Heat balance is here taken as a starting-point for the development of a method of calculating time required for freezing and thawing of an ice layer. ***Ed. Emblik.*** *Sulzer Technical Review*, v. 41, no. 3, 1959, p. 13-16.

11879* Radiant Conditioning of Enclosed Rooms. Deals with exchange of radiation in a room with at least partially reflective bounding surfaces. Heat flows involved in radiation exchanges are reduced to measurable radiation factors, such as radiant and irradiation temperatures, which may be regarded as physical measures of heat as perceived by the human body. ***H. Lueder.*** *Sulzer Technical Review*, v. 41, no. 3, 1959, p. 33-46.

TEXTILES, FIBERS, LEATHER, AND PAPER

11880* The Effect of Biocides on the Survival of Mycorrhizal Fungi. A heavy application of eradicants completely annihilates the mycorrhiza-forming organisms. A light application of the chemicals permits the survival of some fungi, but depresses about 50% their growth-promoting efficiency. Several simple methods of re-establishing fertility in biocide-treated soils are suggested. ***D. J. Persidsky and S. A. Wilde.*** *Journal of Forestry*, v. 58, July 1960, p. 522-524.

11881 Moisture in Textiles. Discusses relationship between the content of moisture in a fiber and that in the atmosphere; effects, such as heat changes, which occur during the sorption process; explanations of the phenomena in terms of physicochemical concepts. ***J. W. S. Hearle and R. H. Peters.*** 203 pp. 1960. Butterworths Scientific Publications Ltd., London. (TS1449 H35m)

11882* Concentration Gradients in Boundary Layers of Streaming Fibre Suspensions. Measurements on pulp stock for paper manufacture indicate that the concentration of suspended particles is not zero near a wall as was previously assumed. Particles found in the boundary layer are different from those of the bulk suspension. Standard filtration equations are not applicable to a suspension of the above mentioned particles. ***Börje Steenberg and Douglas Wahren.*** *Svensk Papperstidning*, v. 63, no. 11, June 15, 1960, p. 347-355.

11883* Paper Smoothness—Literature Review. Reviews literature on surface smoothness of paper and its effect on printability. Among factors affecting surface smoothness the following were studied: pulp, press section, dryer section, calandering, storage of paper before and after calandering. (*In Swedish.*) Pappers ytjämnhet—Litteratursammanställning. ***Albin Andersson.*** *Svensk Papperstidning*, v. 63, no. 11, June 15, 1960, p. 356-368.

WELDING AND JOINING

11884* Possibility of Increasing the Resistance of Non-Rusting Welds to Intercrystalline Corrosion by Increasing the Cooling Speed. Application in Ar arc welding of forced cooling of the weld by means of water supplied to the hot and molten metal does not change the mechanical properties of the weld joint; increases resistance of the multilayer of welds (insufficiently stabilized by Ti) to internal crystalline corrosion. (*In Russian.*) O vozmozhnosti povysheniia stoĭkosti nerzhaveiushchikh shvov protiv mezhkristallitnoĭ korrozii pri uvelichenii skorosti okhazhdeniia. ***A. I. Akulov and V. V. Spitsyn.*** *Avtomaticheskaia Svarka*, v. 13, no. 6(87), June 1960, p. 12-18.

11885* Formation of Silicon Fluoride on Heating the Flux During Welding and Drying. On heating above 400 C from the surface of particles of fluxes containing SiO_2 and CaF_2, gaseous $SiFe_4$ is given. Intensity of this formation is proportional to temperature and duration of heating process, to surface of particles of flux and to SiO_2 and CaF_2 content in the flux. In welding under fluxes containing CaF_2 and considerable SiO_2 amounts, formation of SiF_4 depends on structure of flux. (*In Russian.*) O vydelenii ftoristogo kremniia pri nagreve fliusa v protsesse svarki i pri sushke. ***V. V. Podgaetskii and T. P. Novikova.*** *Avtomaticheskaia Svarka*, v. 13, no. 6(87), June 1960, p. 19-22.

11886* Electro Slag Welding of Elements of Spherical Electrodehydrators. This type of welding must often replace electric arc welding by hand when the mounted elements involve a sheet thickness less than 40 mm (20 to 30 mm). It can be applied to rectilinear welds with DC and AC with the help of rack and pinion, power fed railless apparatus. Curvilinear and spherical parts should be welded with DC of reversed polarity. Thus higher mechanization of welding and continuity of the mounting work are obtained. (*In Russian.*) Elektroshlakovaia svarka elementov sfericheskikh elektrodegidratorov. ***V. G. Radchenko and V. S. Shaniuk.*** *Avtomaticheskaia Svarka*, v. 13, no. 6(87), June 1960, p. 37-41.

11887 Frontiers of Welding Progress. Study of the tungsten arc; electrodes for Type 347 stainless; data sheet—seam and spot weld defects; welding and heat treatment of steel pipe; welding high-strength steels; quality control in welding; applications for welding methods. *Metal Progress*, v. 78, no. 1, July 1960, p. 83-92.

11888 Welding Solid-Fuel Rocket Motor Cases. Hot cracking of weld metals and notch sensitivity of high-strength steels at maximum strength levels pose serious challenges to fabricators of rocket motor cases. Most failures stem from poor welding techniques and inadequate inspection. Discusses some recommended practices to combat these problems. Summary of information from Defense Metals Information Center Reports (DMIC Report No. 118, Oct. 12, 1959, and a recent DMIC Memorandum) by M. D. Randall, R. E. Monroe, H. W. Mishler, and P. J. Rieppel. Information was collected with the cooperation of many companies in the aircraft and missile industries. ***P. J. Rieppel.*** *Metal Progress*, v. 78, no. 1, July 1960, p. 105-110.

11889 A New Method for Brazing Aluminum and Magnesium. The New Rochelle Tool Corp. of New Rochelle, New York, has developed a complete new and unique type of heat source for brazing metals in which very close temperature control is required. Fundamentally the so-called Thermoduction method consists in the pumping of heated liquids through metal dies, designed for the particular application, which contact the work being brazed. ***Wallace C. Rudd.*** *Metal Treating*, v. 11, no. 3, June-July 1960, p. 19-22.

11890* Chemical-Metallurgical Investigations of Welds. Relationship between the metallurgy of steelmaking and the metallurgy of welding; welding experiments; influence of the Mn-S ratio upon the constitution of the sulfide; importance of particle size and distribution of sulfur segregates; grain boundary segregation of sulfide; inclusions due to deoxydization; influence of the Mn-Si ratio and of the rate solidification; inclusions in the parent material adjacent to the weld. (*In German.*) Chemisch-metallkundliche Untersuchungen an Schweissnähten. ***K. Born.*** *Schweissen und Schneiden*, v. 12, Apr. 1960, p. 139-146.

11891* Welding Fixtures in Structure Steelwork. Advantageous fixtures used in structural steelwork were studied, such as tacking of plate purlins, deposition of long fillet and butt welds, welding of box sections, tacking of deep-plate girders, welding of rails to girders, batch production, and tacking and welding of parts for tubular masts. (*In German.*) Schweissvorrichtungen im stahlbau. ***A. Coblenz and R. Oswald.*** *Schweissen und Schneiden*, v. 12, June 1960, p. 262-266.

11892* Welded High Strength Pipes. From average carbon and low-alloy steels (Su and 14 KhGS) and after thermal treatment, pipes with a yield point above 40 kg/mm² and a tensile strength above 55-60 kg/mm² can be obtained. Use of a large diameter of average C steel and of steel 14 KhGS in a thermally hardened state considerably decreases expense of metal in pipe-lines working at relatively high pressures. (*In Russian.*) Svarnye truby povyshennoĭ prochnosti. ***Z. N. Kraĭl'shchikov, E. N. Schvach, and S. E. Nechepurenko.*** *Stroitel'stvo Truboprovodov*, v. 5, no. 6, June 1960, p. 11-14.

11893* Study of Seam Welding Steel of Different Thickness. The character of the processes during welding of parts of various thickness under hard or soft conditions is somewhat different. In the first case, the heating process is basically determined by the field of the heat sources, depending on the electric field of the current. Under soft conditions, the high effect on the temperature field exhibits processes of heat transfer occurring within the limits of a continuous change in the electric current field. (*In Russian.*) Issledovanie rolikovoi svarki stali neravnoĭ tolshchiny. ***B. D. Orlov and P. L. Chuloshnikov.*** *Svarochnoe Proizvodstvo*, 1960, no. 4, Apr., p. 3-7.

11894* Oxidizing Capacity of Steam as a Shield During Welding. (*In Russian.*) Okislitel'naia sposobnost' vodianogo para kak zashchitnoi sredy pri svarke. ***L. S. Sapiro.*** *Svarochnoe Proizvodstvo*, 1960, no. 4, Apr., p. 31-32.

11895 Halogen Additions to Inert-Atmosphere Weld Chambers. In concentrations up to 2%, most halogen-gas additions to Ar atmospheres used in W-arc welding of Zircaloy-2 and -3 resulted in an increase in the depth-to-width ratio of weld-puddle geometry. As the additive concentration was increased, life of the W electrode was affected conversely. ***R. L. Matchett and W. L. Frankhouser.*** *U. S. Atomic Energy Commission, WAPD-223*, May 1960, 18 pp. (UF767 Un3.1wa Contin.)

11896 Resistance Welding Electronic Component Leads to Nickel-Clad Copper Wire. Laboratory investigation leads to recommendations on best welding setup and on optimum welding schedules for this type of work. ***W. L. Hughes.*** *Welding Journal*, v. 39, July 1960, p. 284s-291s.

11897 New Alloys for Brazing Heat-Resisting Alloys. Low-melting Ni-Pd base brazing alloys, containing additions of Be and/or Si, were developed. The most promising brazing alloy, containing 0.25Be, 0.49Si, 44.3Ni, 54.96Pd, has a melting temperature range of 2040 to 2120 F. ***W. Feduska.*** *Welding Journal*, v. 39, July 1960, p. 292s-300s.

11898 Techniques for Welding Al-Mg Alloys. To obtain a maximum weld quality great care must be taken to utilize: properly cleaned materials, optimum welding conditions and

adequate tools and fixtures. By controlling these three items, superior quality fusion welds can be made with the Al-Mg alloys. ***Daniel M. Daley, Jr.*** *Welding Journal*, v. 39, July 1960, p. 301s-305s.

11899 Explosion-Bulge Tests of Armor Weldments. A study was made of ferritic Grades 260, 230, and 180 electrodes as well as austenitic Type 307 electrodes deposited in butt joints in a single heat of 1-in. Army Ordnance armor plate. Specimens were explosion tested over a range of temperatures to determine the ductile-to-brittle performance temperature range of the weldments. There was little difference in the performances of the weldments made with the high-strength ferritic and the austenitic electrodes; weldments prepared with the Grade 180 electrodes were definitely inferior to the other weldments. ***S. M. Silverstein, R. P. Sopher, and P. J. Rieppel.*** *Welding Journal*, v. 39, July 1960, p. 309s-314s.

11900 Notch-Rupture Strength of Type 347 Heat-Affected Zone. It was found that, in the as-welded condition, the notch-rupture strength of the heat-affected zone of this stainless steel was seriously impaired. Loss in notch-rupture strength could be recovered by giving the welded joint a post-weld solution heat treatment. Reduction in notch-rupture strength was attributed to the mechanical strain produced during welding. ***R. J. Christoffel.*** *Welding Journal*, v. 39, July 1960, p. 315s-320s.

11901 Induction-Pressure Welding of Girth Joints in Steel Pipe. Welding studies were made with the induction-pressure welding process on standard 6⅝ in. OD pipe. It was found that satisfactory welds, which had bend ductility and tensile strengths in excess of those specified by API for field-welded joints, could be made consistently with proper welding conditions, Ar shielding and a square-butt closed-joint design with good joint alignment. Readily adaptable to in-plant or yard joining operations and, with adequate engineering design, the process could be used on a pipe-line spread under actual field conditions. A practical limit for field-welding applications would probably be about 20 in. in diam. ***R. L. Koppenhofer, W. J. Lewis, G. E. Faulkner, P. J. Rieppel, and H. C. Cook.*** *Welding Journal*, v. 39, July 1960, p. 685-691.

11902 Distortion in Welded Steel and Corrective Measures. Distortion from longitudinal and transverse shrinkage, angular distortion, peening, flame shrinking are discussed. ***Omer W. Blodgett.*** *Welding Journal*, v. 39, July 1960, p. 692-697.

11903 Carbon-Dioxide Welding of Heavy Sections for Radio Towers. Describes application of carbon-dioxide welding to construction of large radio towers fabricated for the Navy. Unique feature of the operation was the application of the CO_2 process to the welding of heavy low-alloy plates up to 1 in. thick to solid rounds varying in diameter from 6 to 11 in. Production experience established that CO_2 welding was an economic, efficient and satisfactory solution to the unique problems encountered in this project. ***G. D. Ries and J. Myers.*** *Welding Journal*, v. 39, July 1960, p. 698-703.

11904 Internal Welding of Tubes to Tube Sheets. . . . can be accomplished by inserting a W-arc torch through the tube-sheet hole to rear of the tube sheet, and fusing tube to tube sheet at that point. ***E. W. Rowlands, Jr. and J. C. Cooksey.*** *Welding Journal*, v. 39, July 1960, p. 704-710.

11905 Application of Flame Fluxing With Acetylene, City Gas and Propane. Flux in conjunction with propane gas is gaining rapid popularity in Canada. Many advantages are claimed such as savings in cost, availability, little or no cylinder handling, no cylinder rental, and reduced or no delivery charge. ***Lee S. Wade.*** *Welding Journal*, v. 39, July 1960, p. 711-715.

11906* Possibilities of Metal Glueing. Adherence to working conditions, knowledge of manifold amounts of influence, and experience regarding behavior under service conditions are the preliminary conditions for metal glueing. Synthetic-resin glues call for closer attention, because their properties are different from those of metals. Little specific strength, nonlinear stress-strain behavior, and peculiar creep phenomena require designs that have to be in line with the glueing technique. (*In German.*) Möglichkeiten des Metallklebens. ***Alexander Matting.*** *Zeitschrift für Flugwissenschaften*, v. 8, June 1960, p. 153-161.

See also: **11619** (high-strength steels for welded structures).

MISCELLANEOUS

11907* Practical Ways to Collect Beryllium Dust. I. Hood design, enclosure techniques, air flows, local exhaust ventilation, process ideas, are few of many practical methods presented. Answers to your beryl ventilation problem whether you machine, grind, vacuum cast, sinter, fabricate, sublimate, chlorinate, fuse or reduce metal from salt. ***A. J. Breslin and W. B. Harris.*** *Air Engineering*, v. 2, no. 7, July 1960, p. 34 + 3 pages.

11908* College Students' Attitudes Toward the Professions. Considers question of why college graduates, who consider themselves professionals and who have been trained professionally, do not necessarily have "the professional attitude and orientation". ***Donald P. Laboskey.*** *American Dietetic Association, Journal*, v. 37, July 1960, p. 13-15.

11909* A Measure of Predictive Precision in Regression Analysis. Confidence limits discussed here are unbiased, but nothing about optimality in any sense is known. Neyman's shortness of the system of confidence intervals used is calculated. A parameter enters the problem which makes it impossible to use Neyman's shortness as an over-all measure of precision. ***H. Linhart.*** *Annals of Mathematical Statistics*, v. 31, no. 2, June 1960, p. 399-404.

11910* A Generalized Pitman Efficiency for Nonparametric Tests. Asymptotic expressions up to terms of order n^{-2} are given for the efficiency of the Wilcoxon two-sample test relative to the standard-normal test and t-test for nearby alternatives. The first term is the well-known Pitman efficiency; the remaining terms are corrections for finite sample sizes. Efficiency values are given for finite sample sizes in the case of normal and rectangular distributions. ***H. Witting.*** *Annals of Mathematical Statistics*, v. 31, no. 2, June 1960, p. 405-414.

11911* An Elementary Proof of the AEP of Information Theory. Properties of the sequence of random variables $-(1/n) \log p$ are obtained for an arbitrary, not necessarily ergodic or stationary, information source. These permit an elementary combinatorial proof of the AEP (asymptotic equipartition property). ***A. J. Thomasian.*** *Annals of Mathematical Statistics*, v. 31, no. 2, June 1960, p. 452-456.

11912* Contributions to the Theory of Rank Order Statistics: Computation Rules for Probabilities of Rank Orders. The one-sample rule and two-sample rule are discussed and calculated. ***I. Richard Savage.*** *Annals of Mathematical Statistics*, v. 31, no. 2, June 1960, p. 519-520.

11913* Integrating the Packaging Operation. Packaging requirements take many forms, but gradually the packaging operation is becoming an integrated part of the manufacturing cycle. ***William E. Wood.*** *Automation*, v. 7, July 1960, p. 74-79.

11914 The American Challenge. ***James R. Killian, Jr.*** *Aviation Week*, v. 73, July 4, 1960, p. 21.

11915 Britain's Scientific and Technological Manpower. The problem and its background, technical manpower and its employment in 1956, current and expected demand for scientists and engineers, secondary schools, universities, nonuniversity channels to a technical education, expansion of educational facilities and opportunities, research and development and technological expansion are discussed. ***George Louis Payne.*** 466 pp. 1960. Stanford University Press, Stanford, Calif. (Q149.G7 P29b)

11916* Business and Politics. I. The Business Leader's Role in Politics. ***William V. Merrihue.*** *Business Horizons,* v. 3, no. 2, Summer 1960, p. 38-44.

11917* Business and Politics. II. Business Should Stay Out of Politics. ***Theodore Levitt.*** *Business Horizons,* v. 3, no. 2, Summer 1960, p. 45-51.

11918 Communication, Organization, and Science. Information and entropy, measurement and communication, information and thermodynamics, information, logic and physics, language, science and art, organization and systems and other problems are discussed. ***Jerome Rothstein.*** 110 pp. 1958. Falcon's Wing Press, Indian Hills, Colorado. (Q175 R74c)

11919* Systems of Conservation Laws. Describes a wide class of difference equations for approximating discontinuous time-dependent solutions with prescribed initial data of hyperbolic systems of nonlinear conservation laws. Prefers those which have the smallest truncation error and in which the discontinuities are confined to a narrow band of 2–3 meshpoints. ***Peter Lax and Burton Wendroff.*** *Communications on Pure and Applied Mathematics,* v. 13, no. 2, May 1960, p. 217-237.

11920 A Presidents' Panel Report. Politics: Business Takes the Plunge. ***Joseph R. Marshall.*** *Dun's Review and Modern Industry,* v. 76, no. 1, July 1960, p. 40-42.

11921 Elements of Materials Science. An Introductory Text for Engineering Students. Discusses engineering requirements of materials, interatomic attractive forces, arrangement of atoms in materials, metallic phases and their properties, ceramic phases and their properties, organic materials and their properties, multiphase materials; equilibrium and nonequilibrium relationships, modification of properties and other problems. ***Lawrence H. Van Vlack.*** 528 pp. 1959. Addison-Wesley Publishing Co., Inc., Reading, Mass. (TA403 V26e)

11922 Engineering Mathematics. Discusses limits, convergency and divergency of series; partial fractions and summation of series; differentiation; integration; expansion of functions in power series; tangents, normals, curvature; determinants; plane co-ordinate geometry-straight line, circle, parabola; conic sections—ellipse and hyperbola; area under a curve; first-order differential equations; and other problems. ***J. Blakey and M. Hutton.*** 603 pp. 1960. Philosophical Library, New York. (QA37 B58e)

11923* How to Teach Civil Engineering. Engineering educators suggest curricula improvement as a way to attract more students to civil engineering. *Engineering News-Record,* v. 165, no. 1, July 7, 1960, p. 21-22.

11924 From Tin Foil to Stereo. Evolution of the Phonograph. ***Oliver Read and Walter L. Welch.*** 524 pp. 1959. Howard W. Sams & Co., New York. (TS2301.P3 R22f)

11925 Heredity and Evolution in Human Populations. Discusses variety, the principles of heredity applied to populations, methods of evolutionary change in human populations, genes and evolution, race formation, isolated populations, small communities, and a look ahead. ***L. C. Dunn.*** 157 pp. 1959. Harvard University Press, Cambridge. (QH431 D92h)

11926 Prevention of Mercury Poisoning. Deals with precautionary measures necessary to avoid Hg poisoning during its manipulation, and describes a method of decontaminating areas on which spillage has occurred. ***S. G. Luxon.*** *Industrial Chemist,* v. 36, June 1960, p. 291.

11927* Safety Considerations in Handling Encapsulants. ***John Delmonte.*** *Insulation,* v. 6, July 1960, p. 41-42.

11928* Method to Obtain the Character Tables of Nonsymmorphic Space Groups. Method is based on the possibility of obtaining all the irreducible representations of a group, if one knows all the irreducible representations of its invariant subgroup of index 2 or 3. It turns out that all the space groups have an invariant subgroup of index 2 or 3. ***J. Zak.*** *Journal of Mathematical Physics,* v. 1, no. 3, May-June 1960, p. 165-171.

11929* Numerical Integration of the Transport Equation With No Angular Truncation. For any given azimuth-independent scattering law, it is shown that the neutron transport equation with external source is rigorously equivalent to a coupled system of Fredholm integral equations. These are derived both for vacuum and periodic boundary conditions. A numerical integration scheme is given for solving these integral equations with no angular truncation error. ***Herbert S. Wilf.*** *Journal of Mathematical Physics,* v. 1, no. 3, May-June 1960, p. 225-230.

11930* Asymptotic Integration of the Differential Equation for a Special Case of Symmetrically Loaded Toroidal Shells. Deals with the special case of toroidal shells where the meridian circles have the axis of rotation as common tangent at the origin. ***Osmund Jenssen.*** *Journal of Mathematics and Physics,* v. 39, no. 1, Apr. 1960, p. 1-17.

11931 Khrushchev in America. N. S. Khrushchev's speeches in Washington, D. C., New York, Los Angeles, San Francisco, Iowa, Pittsburgh, and Moscow. Pictorial review of various visits. ***N. S. Khrushchev.*** 231 pp. 1960. Crosscurrents Press, New York. (DK274 K52k)

11932* Maintenance Engineering Handbook. Compiled for use by those people in industry who carry on the function of maintenance; will also be useful to management personnel since it contains treatment of the management phases of maintenance. Discusses management, information on the selection, installation, and upkeep of equipment and services. ***L. C. Morrow, editor.*** Various paging. 1957. McGraw-Hill, New York. (TS155 M83m Ref.)

11933 Man's Next Billion Years; On Our Conquest of the Universe. ***Allan Bacon.*** 89 pp. 1959. Exposition Press, New York. (QH369 B13m)

11934 Measurement Definitions and Theories. Papers from a five-part symposium on measurement sponsored by the American Association for the Advancement of Science. Part I attempts to characterize the meaning of measurement. Part II is entitled "Some Theories of Measurement". Part III deals with the problems of measurement in physics. ***C. West Churchman and Philburn Ratoosh, editors.*** 274 pp. 1959. John Wiley & Sons, New York. (QC39 C47m)

11935 Metalwork and Enamelling. This work, originally published nearly 50 years ago, has long been recognized as the standard textbook for those employed in the gold and silversmiths' trades. It will appeal to craftsmen in any branch of this trade as well as to workers in all professional and research laboratories, museum, scientific, and craft centers where problems involving the construction or repair of scientific appliances and other work in metal are involved. ***Herbert Maryon.*** 4th Ed. 335 pp. 1959. Dover Publications, Inc., New York. (TS725 M36m4)

11936 Mountains in the Sea. The Story of the Gough Island Expedition. Gough Island, a part of the Mid-Atlantic Ridge, was largely unexplored before this survey by British scientists in 1955 and 1956. ***Martin Holdgate.*** 222 pp. 1958. St. Martin's Press, New York. (Q115 H71m)

11937 Nature and Properties of Engineering Materials. Emphasizes basic principles necessary for an understanding of the fundamental nature and properties of engineering materials and makes clear the significance of these principles in engineering practice. Intended for use as a text in basic courses in engineering materials and requires knowledge of general chemistry, general physics, and some calculus. Objective is to present a unified treatment of a variety of materials, stressing the fundamental which provide a common basis for explaining the behavior of the varied materials. ***Zbigniew D. Jastrzebski.*** 571 pp. 1959. John Wiley & Sons, New York. (TA403 J31n)

11938 The Nature of Science and Other Essays. Discusses the nature of science, concept formation and operational definition, quantitative inductive procedures, causality and the counterfactual conditional, and the problem of real numbers. ***David Greenwood.*** 95 pp. 1959. Philosophical Library, Inc., New York. Q171 G85n)